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COMMUNITY WATER SUPPLY STUDY, CINCINNATI, OHIO - STANDARD METROPOLITAN STATISTICAL AREA

Bureau of Water Hygiene
Cincinnati, Ohio

31 July 1970

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COMMUNITY WATER SUPPLY STUDY

CINCINNATI, OHIO

Standard Metropolitan Statistical Area

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
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Bureau of Water Hygiene, Region V
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George G. Fassnacht, Indiana
A. L. Fishback, Ohio
N. G. Johnson, Kentucky

PARTICIPANTS

The following persons made major contribution to the successful completion of this project:

PROJECT DIRECTION

Donald W. Marshall - Regional Program Representative

FIELD EVALUATION TEAM

T. L. Campbell
J. H. Cook
G. F. Craun
W. Davis
E. Dickason
E. K. Ernstrom
J. F. Harrison
H. M. Holman
T. N. Hushower
R. N. Jungclaus
W. R. Keating
T. L. Lothrop
O. T. Love, Jr.
F. D. Maddox
F. L. Nelson
F. W. Norris, Jr.
W. S. Rynearson
H. F. Smith, Jr.
W. J. Whitsell
G. A. Wright

REPORT PREPARATION

F. Donald Maddox
Gale A. Wright
Diane L. Rosen

RECOMMENDATIONS, CONCLUSIONS, AND FINDINGS

To investigate public water supply systems in the United States, the Bureau of Water Hygiene of the U. S. Public Health Service, with the cooperation of State and local health departments, and water utilities, conducted a nationwide Community Water Supply Study (CWSS) during 1969 in eight geographically distributed Standard Metropolitan Statistical Areas (SMSA) and the State of Vermont. The study included the Cincinnati SMSA with 64 public water supply systems.

Each numbered paragraph of this section includes a recommendation supported by lettered conclusions and findings derived from the facts collected in the study. Figures quoted are to the nearest one percent or the nearest 1,000 persons. Conclusions and findings which do not directly support specific recommendations are listed under the heading "General Conclusions." Summary data are found in Table 4 on page 24.

I. More emphasis should be placed upon the public health surveillance of public water supply systems. This should be accomplished by increasing Water Supply Program staffs of State and local health departments. Increased State surveillance should be directed to:

a. Adequate quality surveillance in accordance with State and local policies.

b. Annual visitation and sanitary survey of public water supply systems by the appropriate regulatory agency. Present visits often do not include a complete sanitary survey of the systems visited.

c. Planning for future development.

A. Health surveillance needs to be improved over the community water supply systems of the Cincinnati SMSA. With 11 parameters considered for each system, the Kentucky systems had six systems with no unsatisfactory parameters, eight with one to three unsatisfactory parameters, and one with more than three unsatisfactory parameters (Wilder was not rated). The Indiana systems had three with no unsatisfactory parameters and four with from one to three unsatisfactory parameters. The Ohio systems had 11 with no unsatisfactory parameters, 17 with from one to three unsatisfactory parameters, and five with more than three unsatisfactory parameters. Recent sanitary surveys (within the last three years) were reported for 27 of the 56 community water supply systems. Nineteen of the 29 which did not report recent sanitary surveys were systems which purchased water from other systems and only maintained a distribution system.

B. Special water supply systems serving trailer parks, water haulers, and institutions are infrequently checked for bacteriological safety, are not under State surveillance, and often have serious sanitary

defects. The eight systems in this group had six with from one to three unsatisfactory parameters and two with more than three unsatisfactory parameters. Trailer parks and institutions by State policy are not subject to the same requirements on sampling, surveillance, and operator certification as community water supply systems.

II. Operator training should be expanded and water works operators should be made aware of the importance of participating in available training courses.

A. Adequate technical training is lacking. With the exception of the larger systems, such as Cincinnati, Ohio and Newport, Covington, and Kenton County Water District #1, Kentucky, the majority of the operating personnel of the systems surveyed had little short course or technical training, other than on-the-job training, in the operation and management of community water supply systems. Most operator experience and capability has been obtained through on-the-job experience. Such experience does not necessarily adequately prepare the operator to meet the changing conditions which may be faced by any system.

III. Effective cross-connection control programs should be developed for the elimination of sanitary defects in community water supply systems.

A. In general, effective programs for the elimination of hazardous cross-connections are not provided by the water works industry in the Cincinnati SMSA. One community water supply system reported a positive policy and program for the detection and elimination of hazardous cross-connections. Most community water supply systems rely upon building inspections which are conducted on new construction and major remodeling only, with no periodic routine inspections of potentially hazardous users.

IV. Laboratory capabilities should be increased for both State and local facilities.

A. Adequate chemical analysis is not done for most systems. Chemical analyses for the constituents limited by the Drinking Water Standards had not been obtained for 37 community systems (66%) as judged by the surveying engineer. Actually, probably no system has periodic analyses done for <u>all</u> of the constituents listed in the Standards. This is primarily due to a lack of laboratory resources.

V. Major shortcomings in water supply operating practices should be corrected.

A. Adequate safety provisions for the handling of chlorine gas were generally lacking. Twenty-one of the 31 systems using gas chlorination did not have adequate provision for protection against the hazards of use of chlorine gas.

B. The bacteriological sampling programs for many community water supply systems were inadequate in numbers of samples taken and in representation of the distribution system. Thirty-four systems did not have records of adequate numbers of samples taken. Many of the small supplies took samples from fixed locations not representative of the distribution system (usually taken in the middle of town or at the treatment plant).

C. The maintenance of adequate (0.1 ppm or greater) chlorine residuals in distribution systems was not practiced by many systems. However, by comparing the results by State portions of the SMSA, the following variations in this practice by State can be noted:

a. The Indiana systems (four ground water supplies serving seven distribution systems) averaged a chlorine residual of 0.9 ppm with no samples falling below 0.1 ppm.

b. In Kentucky, which requires chlorination of all community water supply systems, one ground water and four surface systems served 16 distribution systems. Three systems, including Silver Grove which did not chlorinate, did not carry chlorine residuals of 0.1 ppm or greater throughout the distribution system. These systems served 9,000 people. Adequate chlorine residuals were found for 13 systems serving 213,000 people or over 96 percent of those served by community water supply systems in the Kentucky area.

c. In Ohio four surface and 24 ground water sources served 33 distribution systems. Three systems serving 4,000 people did not provide chlorination. Chlorine residuals were not taken for four systems which served 41,000 people. Chlorine residuals taken on the remaining 26 systems demonstrated that only six systems were maintaining a residual of 0.1 ppm or greater throughout their distribution systems. These systems served about 45,000 people or less than 5% of the population served. The 19 systems which were not found to maintain adequate chlorine residuals throughout their distribution systems served 996,000 people. Therefore, over 91 percent of the people served by community water supply systems in the Ohio portion of the Cincinnati SMSA were being served by systems which did not maintain adequate chlorine residuals throughout their distribution systems. The Ohio State Health Department recommends that community water supply systems provide 0.2 to 0.4 ppm of chlorine throughout the distribution system.

d. For the entire Cincinnati SMSA not more than 25 percent of the population was being served by systems providing adequate chlorination throughout their distribution systems.

D. Check samples for chlorine residuals are not taken often enough by small system operators. The minimum of a daily sample was not practiced by 25 systems.

VI. More adequate funding for management, operation, and improvement of water supply facilities should be provided.

A. The sanitary surveys noted various equipment and structural defects which could be corrected by capital improvement. Those defects considered serious enough to downgrade a system were of the following general description:

a. Inadequate source protection (22 systems)

b. Inadequate treatment capability (8 systems)

c. Low pressure areas (6 systems)

d. Poor maintenance (12 systems)

VII. Where practical, all community water supply systems should provide fluoridation.

A. Few of the residents of the Cincinnati SMSA receive the benefits of fluoridation. Despite mandatory fluoridation in the State of Kentucky for cities serving more than 3,000 people, Newport and Covington still do not fluoridate. Only 10 of the SMSA systems serving 96,000 people (less than 10%) fluoridate. This is likely to change, however, after State action against Covington and Newport and implementation of the new Ohio fluoridation law.

VIII. The proliferation of small systems should be discouraged. Where possible existing small systems should be merged with large systems and new service areas should be served by the larger systems.

A. Small community water supply systems (those serving less than 10,000 people) present more risk to the consumer than those serving more than 10,000 people. Table 1 shows there are 44 such systems serving 134,000 people or 10 percent of the people served by community water supply systems in the Cincinnati SMSA.

Table 1 - Evaluation of Systems

Population Served	More than 3 unsatisfactory parameters**		1 to 3 unsatisfactory parameters**		No unsatisfactory Parameters**	
	Systems	Population	Systems	Population	Systems	Population
>10,000	-	-	4	101,900	8	1,048,000
5,000-10,000	1	6,500	6	35,200	3	21,500
1,000-5,000	3	5,680	15	40,030	7	19,870
<1,000*	2	240	4	3,260	2	1,290
Total	6	12,420	29	180,390	20	1,090,660

* Wilder (650 people) was not surveyed
** Eleven parameters considered

Twelve serving 43,000 people (32% of those served by small systems) had no unsatisfactory parameters. Twenty-five serving 78,000 or 59% of

those served by small systems had from one to three unsatisfactory parameters and present intermediate risks to the consumer. Six serving 12,000 (9%) present high risks to the consumer and had more than three unsatisfactory parameters.

B. Systems serving less than 10,000 people are more likely to be poorly maintained and operated than those serving more than 10,000 people. Eleven of the 44 systems serving less than 10,000 people were poorly maintained. Only one of the 12 systems serving more than 10,000 people was poorly maintained.

C. Large community water supply systems (those serving more than 10,000 people) normally present low or acceptable risk to the consumer. Eight of the 12 systems in this population group had no unsatisfactory parameters serving 1,048,000 people. Four systems serving 102,000 people had from one to three unsatisfactory parameters.

D. People served by small systems usually pay more per 1,000 gallons than people served by larger systems. The data shows 850,000 people pay 35 cents per 1,000 gallons (Cincinnati), 214,000 pay 69 cents per 1,000 gallons (20,000 to 100,000 populations), 95,900 pay 85 cents per 1,000 gallons (10,000 to 20,000 populations), 58,200 pay 77 cents per 1,000 gallons (5,000 to 10,000 populations), and 65,100 pay $1.16 per 1,000 gallons (less than 5,000 populations). The increased costs for smaller systems reflect the costs for source development, treatment, maintenance, operation, and billing which must be shared among fewer users.

IX. General Conclusions and Findings

A. Considerable growth of the area served by community water supply systems can be expected for the Cincinnati SMSA. Ninety-one percent (Table 2) of the population of the Cincinnati SMSA is served by community water supply systems. The areas that, at present, are not served by a community water supply system are fringe areas (70 percent of the SMSA, Figure 1) that are rural in nature and sparsely populated to the extent that it would not be economically feasible for such a system to serve them at this time. The development of these rural sparsely-populated areas will encourage the creation of new community water supply systems and/or the expansion of existing systems to serve these areas.

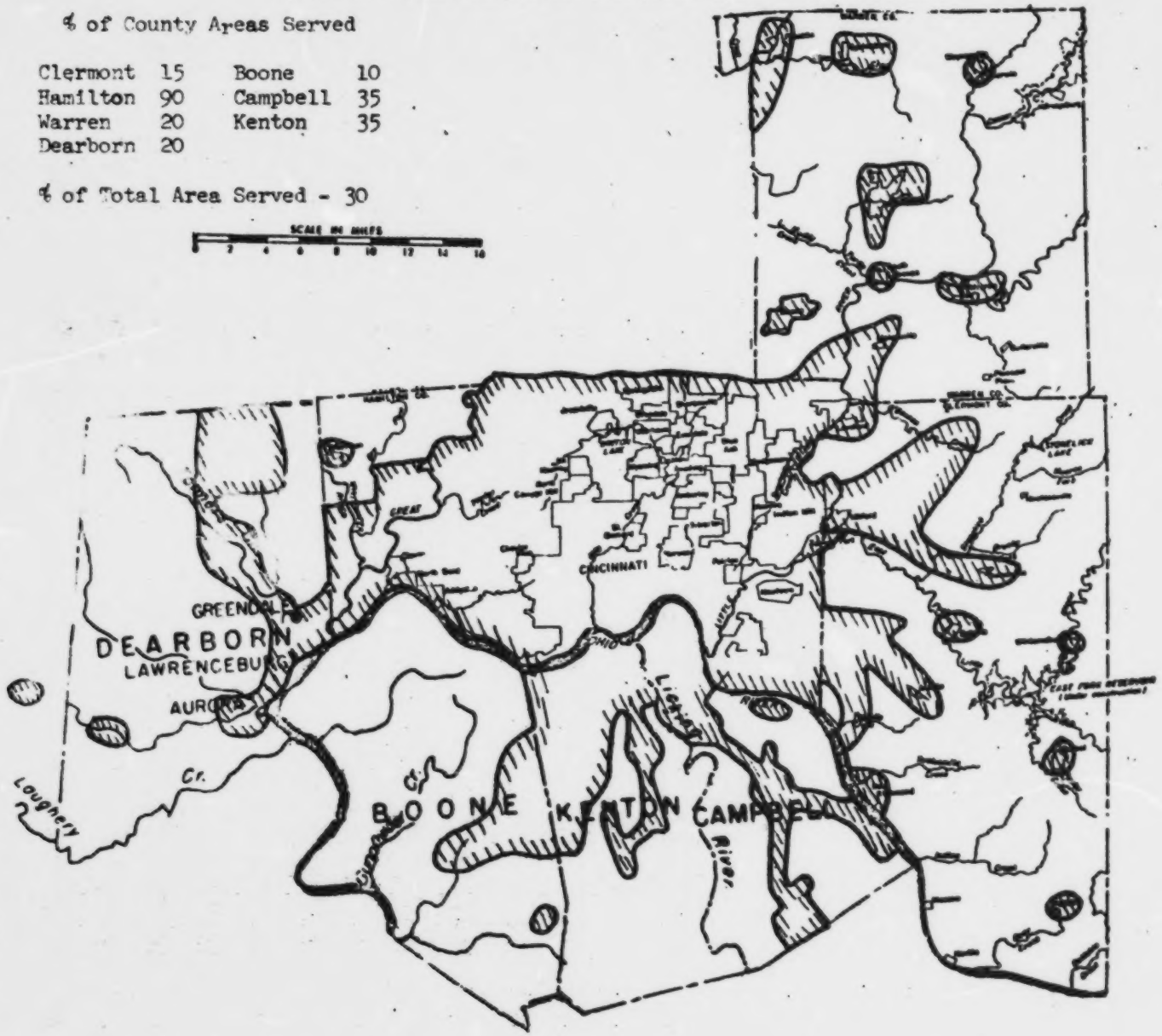
B. Most of the people served by community water supply systems receive water from systems with no unsatisfactory parameters. Twenty systems serving 1,091,000 people (85% of those served), had no unsatisfactory parameters. Twenty-nine serving 180,000 (14% of those served) had from one to three unsatisfactory parameters. Six serving 12,000 people (1% of those served) had more than three unsatisfactory parameters.

Table 2 - Populations Served by
Community Water Supply Systems

County in Cincinnati SMSA	Total Population	Total Served	Community Systems	Percent Served[2]
Dearborn	29,000[3]	20,040	7	69
Total in Indiana	29,000	20,040	7	69
Boone	28,400[4]	21,600	3	76
Campbell	86,700[4]	85,800	6	99
Kenton	123,400[4]	115,340	7	94
Total in Kentucky	238,500	222,740	16	93
Clermont	105,600[4]	54,870	10	52
Hamilton	950,000[4]	940,710	11	99
Warren	86,600[4]	45,760	12	53
Total in Ohio	1,141,200	1,041,340	33	91
Total in SMSA	1,408,700	1,284,120	56	91

1. As determined by evaluation of study data
2. To the nearest 1%
3. Based on 1966 estimate (Rand McNally Road Atlas)
4. Based on 1968 estimate Ohio Kentucky Indiana Regional Planning Authority

FIGURE 1 - AREA SERVED BY COMMUNITY WATER SUPPLY SYSTEMS



C. Most of the large systems use surface water streams as a source, while small systems (those serving less than 10,000 people) use ground water. This is predictable since ground water normally is less costly to develop for drinking water use and where available is used until the volumes required no longer make the use of ground water economical.

Table 3 - Sources of Water Utilized

Population Served	Ground	Surface***
<1,000	6 (4**)	3*
1,000-5,000	16 (3**)	9 (5*)
5,000-10,000	9	1*
10,000-20,000	5	1*
>20,000	0	6 (2*)
Total	36 (7**)	20 (12*)

*System purchases water from a system serving >20,000 people
**System purchases water
***Includes Wilder

D. In general the ground water and surface water resources in the area comprising the Cincinnati SMSA appear to be adequate in quantity for present and expected future demands. The majority of the smaller community water systems utilize ground water as a source of supply. Of the systems using ground water (36) three did not report an adequate quantity of ground water. The construction of additional wells would in all probability satisfy the needs of these three systems.

E. The raw water quality for surface water has changed little over the past five years in the opinion of water treatment plant officials. No changes in raw water quality were reported at Batavia, Covington, Newport, Walton, and Williamsburg. Increased turbidity was reported at Bethel. The construction of a new dam above raw water intakes reportedly slowed the Ohio River, reducing chlorine demand and taste and odor problems for Cincinnati. Improved water quality was also reported by the Kenton County Water District #1. One surface water source serving 8 systems had excessive manganese content.

F. The chemical quality of the ground water is not uniformly acceptable. For nine of the 29 ground water sources manganese, iron, nitrate or total dissolved solids concentrations exceeded recommendations of the Standards. Bacteriologically the ground water appeared to be of excellent quality. Of the total number of raw ground water samples collected during the survey and examined bacteriologically, only those from wells whose construction provided inadequate protection showed the presence of coliforms.

G. The cost of water appears to affect the use of water (Figure 2). Families appear to be reluctant to pay more than $10.00 a month

for the water they use. Costs ranged from $2.50 to $12.70 per four person family per month with 42 systems providing water to four person families at costs ranging from $4 to $10 per month. The six systems which supply water at costs greater than $10 are generally the newer systems or recently improved systems which have high amortization costs to meet. The six systems which supply water at costs less than $4 can be characterized as those systems which amortized their capitalization debt long ago, which purchase water at low cost from another system and which do little more than bill customers.

H. Finished water quality has not been shown to be hazardous to health by any of the analyses done for the study (no samples exceeded the Bacteriological or Mandatory Standards). Bacteriological histories, however, for one year preceding the study showed coliform levels exceeding the Standards for 11 systems serving 36,000 people. Analyses for the study showed 13 systems serving 108,000 people had only fair water quality (samples exceeded the Recommended Standards). In addition, taste and odor qualities are known to be less than good for five systems using surface water to serve 1,049,000 people.

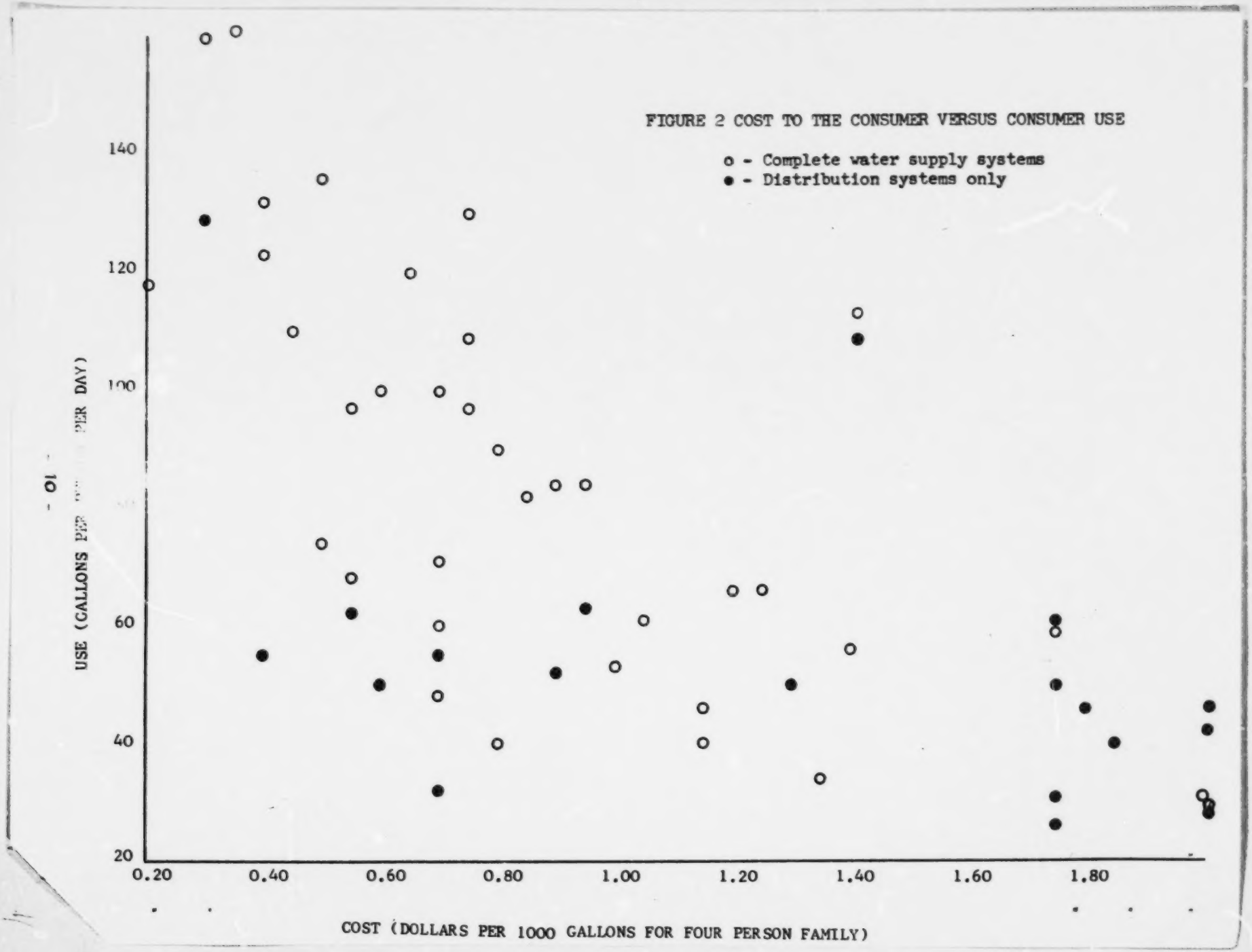


FIGURE 2 COST TO THE CONSUMER VERSUS CONSUMER USE
o - Complete water supply systems
● - Distribution systems only
USE (GALLONS PER PERSON PER DAY)
140
120
100
60
40
20
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
COST (DOLLARS PER 1000 GALLONS FOR FOUR PERSON FAMILY)

INTRODUCTION

The purpose of the Community Water Supply Study (CWSS) was to determine if the American consumer's drinking water met the Drinking Water Standards.* To obtain nationwide coverage, the Bureau of Water Hygiene of the U. S. Public Health Service initiated the CWSS in February of 1969 in nine areas across the country. The field work for the CWSS was conducted by the Bureau of Water Hygiene, in cooperation with the State and local health departments and the water utilities.

This study was designed to give an assessment of drinking water quality, water supply systems, and surveillance programs in urban and suburban areas in each of the nine regions of the Department of Health, Education, and Welfare. These areas were selected to give examples of the several types of water supplies in the country. A whole Standard Metropolitan Statistical Area (SMSA) was the basis of each study, except in Region I where the entire State of Vermont was included, with evaluations made on all public water supply systems, as defined herein, in each study area. This coverage allowed an assessment of the drinking water quality of the large central city, the suburbs, and the smaller communities located in the counties in the SMSA, and the interaction between them.

Specifically, the objectives of this study were accomplished by determining whether or not:

1. The quality of the urban and suburban American consumer's drinking water in the selected study areas exceeded the Constituent Limits of the Drinking Water Standards (DWS);*

2. The water supply systems supplying this drinking water to the consumers were essentially free from major deficiencies;

3. The bacteriological surveillance programs over these water supply systems meet the established criteria (see page 15).

The authority for the Community Water Supply Study is found in Title III, Part A, Section 301, Public Health Service Act, amended (42 U. S. C. 241).

> "Sec. 301 - The Surgeon General shall conduct in the Service, and encourage, cooperate with, and render assistance to other appropriate public authorities, scientific institutions, and scientists in the conduct of, and promote the coordination of, research, investigations, experiments, demonstrations, and studies relating to the causes, diagnosis, treatment, control, and prevention of physical and mental diseases and impairments of man, including water pollution..."

*1962 U. S. Public Health Service Drinking Water Standards; PHS Publ. No. 956, Superintendent of Documents, Government Printing Office, Washington, D. C. 20402, [illegible]

SCOPE

Public water systems in the United States numbered over 19,000 serving some 150,000,000 when last inventoried in 1963.* The remaining 50,000,000 people had private water supplies. Most of the public water systems were small, about 85 percent serving 5,000 or less people. About half of the public was served by about 18,800 systems that each served 100,000 or less persons and the other half (77,000,000) were served by about 400 larger systems. About 75 percent of the public water systems have ground water as a source, while 18 percent use surface water. The remaining 7 percent use a mixture of ground and surface water.

Systems Studied

This study covered 969 public water supply systems, including 885 community water supply systems (91.3% of the total) and 84 special water supply systems (8.7% of the total). For this study the following definitions of the systems were used.

PUBLIC WATER SUPPLY SYSTEM - A water supply system includes the works and auxiliaries for collection, treatment, storage, and distribution of water from the sources of supply to the free-flowing outlet of the ultimate consumer. Water supply systems were included in this study, if they had 15 or more service connections and/or served 25 or more consumers.

Special Water Supply Systems - are those systems serving trailer and mobile home parks, and institutions with resident populations.

Community Water Supply Systems - are all other systems studied in an SMSA.

Study Area

The details of the study area and the definition of Standard Metropolitan Statistical Area (SMSA) are given below.

STANDARD METROPOLITAN STATISTICAL AREA - The boundaries and titles of standard metropolitan statistical areas are established by the Bureau of the Budget with the advice of the Federal Committee on Standard Metropolitan Statistical Areas. An SMSA is a county or group of contiguous counties, which contains at least one city of 50,000 inhabitants or more or "twin cities" with a combined population of at least 50,000. In addition to the county, or

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*Statistical Summary of Municipal Water Facilities in the United States, January 1, 1963: PHS Publ. No. 1039, Government Printing Office, Washington, D. C. 1965, 66 pp.

counties, containing such a city or cities, contiguous counties are included in an SMSA if, according to certain criteria, they are essentially metropolitan in character and are socially and economically integrated with the central city.

The Cincinnati, Ohio SMSA was selected to represent those portions of mid-America using surface water receiving a considerable amount of industrial discharge in addition to municipal wastes and agricultural runoff.

This SMSA includes Dearborn County in Indiana; Boone, Campbell, and Kenton Counties in Kentucky; and Clermont, Hamilton, and Warren Counties in Ohio. Figure 3 shows the approximate location of each of the community water supply systems studied. Table 2 (page 6) shows the population for each county of the SMSA, the population of each county served by community water supply systems, and the percent of the population of each county served by community water supply systems. Summary data on the systems studied are tabulated in Table 4 on page 24. As to location and population served Table 4 shows:

12 supplies serve more than 10,000 people (total of 1,150,000)
7 in Ohio serving 952,000
5 in Kentucky serving 198,000

10 supplies serve 5,000 to 10,000 people (total of 63,000)
7 in Ohio serving 46,000
2 in Indiana serving 11,000
1 in Kentucky serving 6,000

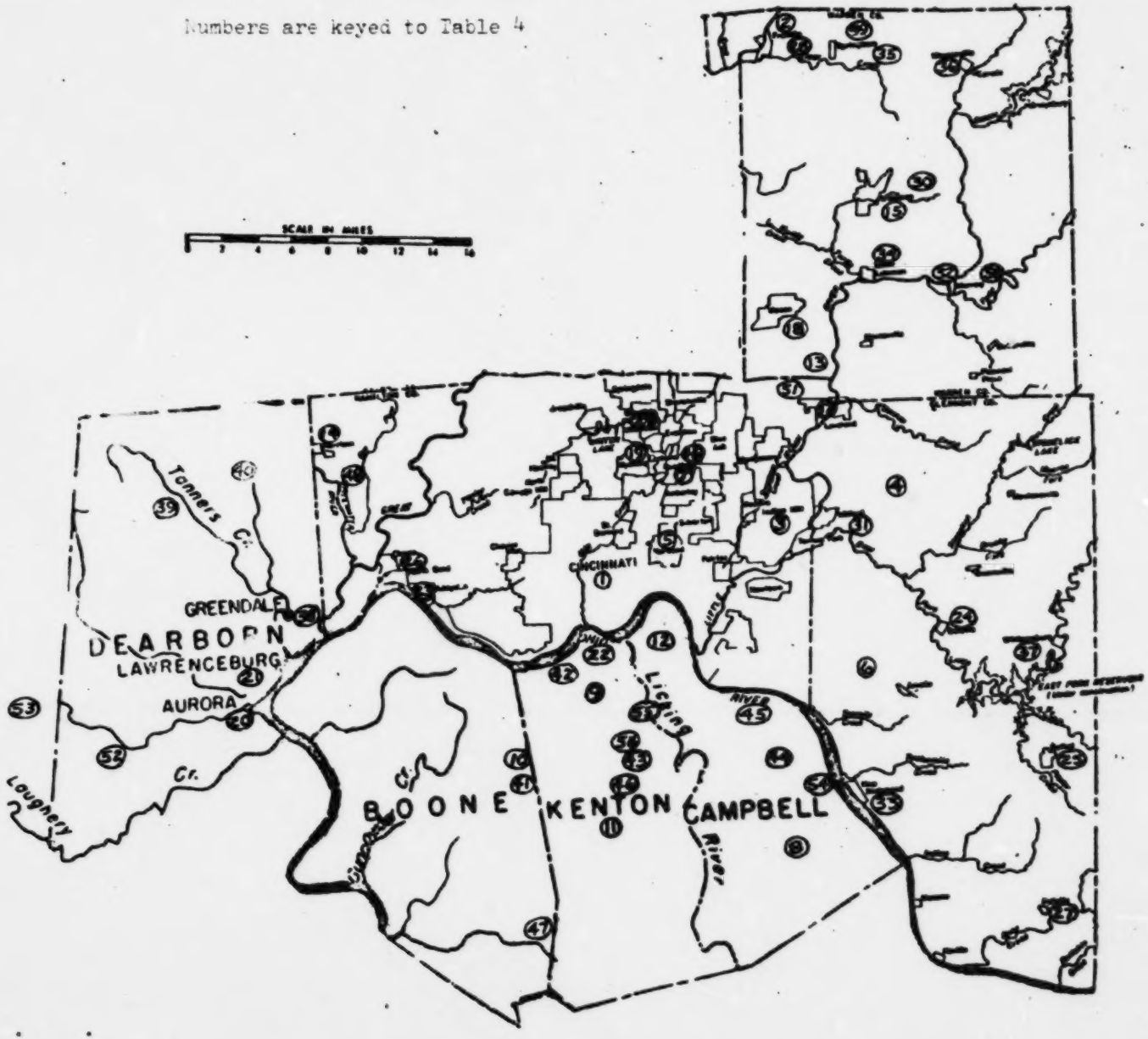
25 supplies serve 1,000 to 5,000 people (total of 66,000)
15 in Ohio serving 42,000
3 in Indiana serving 7,000
7 in Kentucky serving 17,000

9 supplies serve less than 1,000 people (total of 5,000)
4 in Ohio serving 2,000
2 in Indiana serving 1,000
3 in Kentucky serving 2,000

8 special supplies serve trailer parks and institutions
5 in Ohio
3 in Kentucky

Figure 3 - Location of Community Water Supply Systems in the Cincinnati SMSA

Numbers are keyed to Table 4



EVALUATION CRITERIA

Each water supply system was investigated on three bases: 1) drinking water quality was determined by sampling the finished and distributed water and returning these samples to the laboratories of the Bureau of Water Hygiene for bacteriological, chemical, and trace metal analyses, 2) the status of the water supply system facilities was determined by a field survey of the system and the gathering of data on three standard forms, four items were chosen to represent major problems; a) source(s), b) treatment, if any, c) distribution, and d) operation; 3) the status of the surveillance program over the water supply system was evaluated by obtaining bacteriological water quality data for the previous 12 months of record from State and county health department files.

Water Quality Criteria

Water quality was judged either:

(1) Not to exceed the Constituent Limits of the DWS (hereafter called met Drinking Water Standards) or,

(2) To exceed at least one "recommended" Constituent Limit (some are aesthetic parameters), but did not exceed any "mandatory" Constituent Limit (hereafter called Exceeded recommended, but not mandatory limits) or,

(3) To exceed at least one "mandatory" Constituent Limit (hereafter called Exceeded mandatory limits).

The limits for the constituents measured in this study are summarized below.

Physical Constituent Concentration Limits taken from the 1962 U. S. Public Health Service Drinking Water Standards for constituents measured:

RECOMMENDED LIMITS

(If the concentration of any of these constituents are exceeded, a more suitable supply or treatment should be sought.)

Constituent	Limit
Alkyl Benzene Sulfonate (Measured as methylene-blue-active substances)	0.5 mg/l

Constituent	Limit
Arsenic	0.01 mg/l*
Boron	1.0 mg/l**
Chloride	250 mg/l
Color	15 units
Copper	1.0 mg/l
Carbon-Chloroform Extract (CCE)	0.200 mg/l
Cyanide	0.01 mg/l
Fluoride	
Temp. (Ann.Avg.Max.Day, 5 years or more)	
50.0-53.7	1.7 mg/l
53.8-58.3	1.5 mg/l
58.4-63.8	1.3 mg/l
63.9-70.6	1.2 mg/l
70.7-79.2	1.0 mg/l
79.3-90.5	0.8 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Nitrate	45 mg/l
Radium-226	3 uuc/l (pc/l)***
Strontium-90	10 uuc/l (pc/l)***
Sulfate	250 mg/l
Total Dissolved Solids (TDS)	500 mg/l
Turbidity	
Untreated	5 Units
Treated by more than disinfection	1 Unit
Zinc	5 mg/l

*Although the recommended arsenic concentration is 0.01 mg/l, because of interferences in some waters, the concentration of arsenic was only determined to be less than 0.05 mg/l. For the purposes of this study, these waters were considered not to exceed the recommended standard.

**Proposed for inclusion in the Drinking Water Standards.

***If these limits are exceeded, refer to Section 6.2 of the DWS.

MANDATORY LIMITS

(If the concentration of any of these constituents are exceeded, the further use of this water for drinking and culinary purposes should be evaluated by the appropriate health authority because water of this quality represents a potential hazard to the health of consumers.)

Constituent	Limit
Arsenic	0.05 mg/l
Barium	1.0 mg/l
Boron	5.0 mg/l**
Cadmium	0.01 mg/l
Chromium (hexavalent)	0.05 mg/l
Coliform organisms (Measured by membrane filter technique)	Fails std. if: a) Arithmetic average of samples collected greater than 1 per 100 ml b) Two or more samples (5% or more if more than 20 examined) contain densities more than 4/100 ml
Cyanide	0.2 mg/l
Fluoride	
Temp. (Ann.Avg.Max.Day - 5 years or more)	
50.0-53.7	2.4 mg/l
53.8-58.3	2.2 mg/l
58.4-63.8	2.0 mg/l
63.9-70.6	1.8 mg/l
70.7-79.2	1.6 mg/l
79.3-90.5	1.4 mg/l
Gross Beta activity (in the absence of a or Sr-90)	1,000 uuc/l (pc/l)***
Lead	0.05 mg/l
Selenium	0.01 mg/l
Silver	0.05 mg/l

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*Although the recommended arsenic concentration is 0.01 mg/l, because of interferences in some waters, the concentration of arsenic was only determined to be less than 0.03 mg/l. For the purposes of this study, these waters were considered not to exceed the recommended standard.

**Proposed for inclusion in the Drinking Water Standards.

***If these limits are exceeded, refer to Section 6.2 of the DWS.

Facilities Criteria

Source, treatment, operation, and distribution facilities were judged either:

1) To be essentially free from major deficiencies, or
2) To have one or more of the following major deficiencies (where applicable)

a) Inadequate source protection (in absence of disinfection, treatment, or buying chlorinated water or if treatment plant bypasses exist)
b) Inadequate disinfection (if disinfection practiced)
c) Inadequate control of disinfection (if practiced or if purchasing chlorinated water)
d) Inadequate clarification capabilities (if clarification practiced)
e) Inadequate control of clarifification (if clarification practiced)
f) Inadequate pressure (<20 psi) in some or all areas of the distribution system
g) Inadequate maintenance

Bacteriological Surveillance Program Criteria

The bacteriological surveillance program over the water supply system was judged either:

1) To meet the following criteria or,
2) Not to meet one or more of the following,

a) Collection of 70 percent or more of the required number* of bacteriological samples during the previous 12 months of record.
b) Collection of samples for no less than nine months
c) Passing the bacteriological quality standard* during the previous 12 months of record.

*See pages 3-6 of the Drinking Water Standards

METHODS

Field Survey

The regional office staff, in cooperation with the State and local health department officials prepared a listing of all known public water supply systems meeting the definition adopted for this study. The list contained the system name, address, name of the superintendent or person in charge, indication of size and the telephone number. The list was cross-checked with community and subdivision names to eliminate duplication and establish those areas for which the water supply facilities were apparently unknown. A Form PHS-682, Report of Water Supply Used on Interstate Carriers, was prepared for each system from State and local health department records. The completed list became the basis for work schedules for the field engineers.

Actual field surveys were made by one of the 18 PHS engineers from headquarters and the regional offices that made up the field staff. At the option of State and local health department staff members, they made surveys with the PHS engineers. (The staff of the field office made appointments by telephone, for the surveys, one to seven days in advance.)

During the field survey, the engineer completed Forms ECA-19 Municipal Water Supply Sanitary Survey, to provide information on source; treatment; operation; laboratory control; personnel; distribution; surveillance practices; planning for improvements; and water rates. Examples of the standard forms are in the Appendix.

Sampling Program

The following samples were collected and dispatched to various Bureau of Water Hygiene laboratories:

1) Raw water
   One sample for bacteriological analysis.

2) Finished water ready for distribution
   Four or five samples for chemical analyses as follows:

   a) 2½-gallon sample to the Northeast Water Hygiene Laboratory. This was a grab sample for most ground water and small surface water treatment plants, but where possible a 14-day composite was taken. The following analyses were made on this sample:

Arsenic	Cyanide	Sulfate
Boron	MBAS	TDS
Chloride	Nitrate	Turbidity
Color	Selenium	

b) 8-oz. aliquot sample for trace metals analysis was taken out of sample 2)a) above and sent to the Cincinnati Laboratory. The following analyses were made on this sample:

Barium	Copper	Manganese
Cadmium	Fluoride	Nickel
Chromium	Iron	Silver
Cobalt	Lead	Specific Conductance
		Zinc

c) 1-gallon sample for radioactivity analyses was sent to one of the three Bureau of Radiological Health laboratories. It was collected in the same manner as sample 2)a) above. The following analyses were made on this sample:

Specific gamma emitting radionuclides (I^{131}, Cs^{137}, Ba^{140})
Gross Alpha
Gross Beta
Radium-226, if gross alpha exceeded 3 pc/l
Strontium-90, if gross beta exceeded 10 pc/l
Tritium - (run on 10% of samples)

d) 1-gallon sample for pesticide analysis to the Gulf Coast Water Hygiene Laboratory from surface water supplies plus those ground water supplies where sampling was specifically requested by the State or county health officials. It was collected in the same manner as sample 2)a) above. The following analyses were made on this sample:

Aldrin	Dieldrin	Heptachlor Epoxide
Chlordane	Endrin	Lindane
DDT	Heptachlor	Methoxychlor
		Toxaphene

e) 1 activated carbon monitor sample to the Cincinnati laboratory from 110 selected water supplies, 94 of which were from surface sources. Carbon chloroform extract (CCE) and carbon alcohol extract (CAE) concentrations were determined from this monitor.

3) Distribution System
Samples for bacteriological and trace metal analyses at the rate of 10 percent of the number required by Figure 1, of the DWS, with a minimum of two each from any system.

Laboratory Procedures
Bacteriological

All samples were collected in 6-oz. sterile, plastic, wide-mouth, screw-capped bottles which contained 0.2 ml of a 10% solution of

sodium thiosulfate as a dechlorinating agent. This concentration of thiosulfate was sufficient to neutralize a sample containing about 15 mg/l residual chlorine, an amount above any residual that was present. Refrigeration of all samples was required during transportation back to the laboratory. Maximum time between collection and analysis did not exceed 30 hours. The bacteriological procedures were those of Standard Methods.*

The membrane filter (MF) procedure was used for total coliform detection in this study for three reasons. One, larger volumes (100-ml portions) of distributed water could be examined than with the MPN technique; two, the MF procedure yields more precise results; and three, less processing time would be involved per sample, so reexamination of many of the samples could have been made within the 30-hour time limit if required. All potable and source water samples were examined for total coliforms using M-Endo MF broth, incubated at 35°C for 20-24 hours. Because raw water quality varied with its source, three decimal sample portions were filtered, the volume being determined by the estimated water quality.

Any coliform colonies detected in the examination of a sample were further verified by transfer to phenol red lactose for 24- and 48-hour periods at 35°C incubation. All positive phenol red lactose broth tubes then were confirmed in brilliant green lactose at 35°C for verification of total coliforms and in EC medium at 44.5°C for detection of fecal coliforms. This procedure further confirmed the standard total coliform MF test and supplied additional information on the potentially hazardous indication of the presence of fecal coliform in those public water supply systems.

Basic knowledge was also needed on the general bacterial population of potable water. Therefore, the general population of bacterial count (plate count) was also made on all distribution system samples. Sample portions of 1 ml and 0.1 ml in plate count agar (Tryptone-Glucose-Yeast Agar), incubated 48 hours at 35°C were sufficient to yield the desired data.

Chemical

The five samples, as noted above, taken to determine the chemical quality of the finished and/or distributed water were analyzed as follows:

Sample 2)a), General Chemistry.

These constituents were generally determined by Standard Methods, except as listed on the following page.

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*Standard Methods for the Examination of Water and Wastewater, 12th Ed., APHA, AWWA, and WPCF. American Public Health Assoc. New York, N.Y., 1965. 796 pp.

Barium

No standard method existed at the time this study was undertaken. An atomic absorption procedure, which will appear in the next edition of Standard Methods, was used and was found acceptable.

The analysis was made only on those samples that had less than 2 mg/l sulfate because above that concentration the barium precipitates out of solution.

Chloride

A variation of the potentiometric titration procedure was used, which is a tentative method in Standard Methods, page 372. Rather than titrate with silver nitrate to a specified endpoint in millivolts, using a glass electrode and a silver-silver chloride electrode, a standard curve was prepared that related millivolts to chloride concentration. The concentration of an unknown is then determined from the standard curve. The procedure was just as accurate as the titration method and was simpler to carry out.

Fluoride

A fluoride electrode method, which will appear in the next edition of Standard Methods, was used. Precision and accuracy was generally better than any other method and the method was simpler to carry out.

Sample 2)b), Trace Metals - The atomic absorption spectrophotometer method was used for all heavy metals (cadmium, chromium, copper, iron, lead, manganese, silver, zinc, nickel, and cobalt) because its sensitivity, specificity, simplicity and speed of analysis far exceeded the usual wet chemical methods. An atomic adsorption method for these metals will appear in the next edition of Standard Methods.

Sample 2)c), Radioactivity - These radiological constituents were determined using standard radiological counting techniques.

Sample 2)d), Pesticides - No standard procedure for pesticide determinations existed at the time the CWSS was undertaken. Gas chromatography is generally the accepted method of analysis and will appear in the next edition of Standard Methods. Therefore, this technique was used.

Sample 2)e), Organics (CCE and CAE).- These organic constituents were determined using standard extraction techniques.

RESULTS

For the purpose of summarizing results, the water supply systems were divided into four categories; 1) those using surface water or a mixture of surface and ground water as a source; 2) those using wells as a source; 3) those purchasing finished water as a source; and 4) special water supply systems. In the Cincinnati SMSA 56 community water supply systems (see note on Table 5) serving about 1,284,000 people were studied. These systems included 29 using wells, seven using surface water, one using both surface and ground water, and 19 using purchased finished water. The eight special water supply systems included in this report use ground water.

Table 4 gives data on population, unsatisfactory parameters found, source, average daily demand, and per capita use for the systems included in this study. Table 5 shows the number of systems in each source category by the treatment practiced, no treatment, disinfection, disinfection and clarification or clarification. Table 6 shows treatment practice by community size.

The tables of results showing the findings of the sanitary survey, the surveillance survey, and the water quality analyses tabulated by water supply system are shown in Tables I, II, III, IV, V, and VI of Appendix A and are summarized by Tables 7, 8, 9, 10, 11, and 12.

These tables show the following data:

Facilities Evaluation: Tables 7 and 8 (see Appendix A, Table II)

Thirty-seven of the 44 community systems serving a population of less than 10,000 had adequate treatment. Eleven of the 12 systems serving more than 10,000 persons had adequate treatment.

Generally, chlorination was provided to the community water systems and was of adequate capacity. Adequate auxiliary chlorination equipment, however, was not provided by 23 of the 37 source systems. Of the eight systems serving trailer parks and institutions, four provided chlorination.

Six of the eight surveyed systems serving a population of under 1,000 had satisfactory pressure and storage. Fourteen of the 25 systems serving a population of more than 1,000 and less than 5,000 had satisfactory pressure and storage. Six of the ten systems serving populations from 5,000 to 10,000 had satisfactory distribution systems.

The distribution systems of [illegible] of the 12 serving over 10,000 were satisfactory. The special [illegible] and four satisfactory distribution systems and four unsatisfactory distribution systems.

Table 4 - Summary Data on Community Water Supplies

SYSTEM	POPULATION SERVED	UNSATISFACTORY PARAMETERS (see notes)	SOURCE	AVERAGE DAILY DEMAND	WATER USE (GPCD)
Population >10,000					
Ohio					
1 Cincinnati	850000		Ohio River	112.60	132
2 Franklin	11000	b	Ground	1.50	136
3 Indian Hill	15000		Ground	1.80	120
4 M.G.S. Clermont Co.	11900	a,e	Ground	0.78	66
5 Norwood	31000		See Cincinnati	4.00	129
6 P.U.B. Clermont Co.	18000		Ground	1.10	61
7 Reading	15000	a,d,h	Ground	1.85	123
	951900				
Kentucky					
8 Ca[illegible]ell C[illegible]y W.D. #1	44000		See Newport	2.43	55
9 Co[illegible]ton	64000	h	Ohio River	5.46	85
10 Florence	15000		See Kenton Co.	0.75	50
11 Kenton County W.D. #1	40000		Licking River	4.01	100
12 Newport	35000		Ohio River	3.39	97
	198000				
	1149900				
Population 5000 to 10000					
Ohio					
13 Drfd-Hmltn W.D. Warren Co.	5140	a,g	Ground	0.302	59
14 Harrison	5050	a,f,h	Ground	0.360	71
15 Lebanon	6500	a,d,e,f	Ground	1.050	160
16 Lockland	5300		Ground	1.020	190
17 Loveland	7500	a,b,f	Ground	0.570	76
18 Mason	6200		Ground	0.250	40
19 Wyoming	10000		Ground	0.900	90
	45690				

Table 4 (Cont'd)

SYSTEM	POPULATION SERVED	UNSATISFACTORY PARAMETERS (see notes)	SOURCE	AVERAGE DAILY DEMAND	WATER USE (GPCD)
Pop. 5000-10000 cont'd					
Indiana					
20 Aurora	6300	f	Ground	0.517	82
21 Lawrenceburg	5200	f,g,h	Ground	0.250	48
	11500				
Kentucky					
22 Ludlow	6010	h	See Covington	--	--
	63200				
Population 1000-5000					
Ohio					
23 Addyston	1300	a,e,g	Ground	0.040	30
24 Elavia	2200		E. Fork Little Miami River	0.185	84
25 Bethel	3400	b,g	Reservoir	0.180	53
26 Cleves	5000		Ground	0.330	66
27 Felicity	1460	a,b,c,f,h	Ground	0.050	34
28 Franklin W.D. Warren Co.	2100	a,e	See Franklin	0.065	31
29 Glendale	3000	a,d,f	Ground	0.300	100
30 Lbn-Frkln W.D. Warren Co.	4070	a,e,g	See Lebanon	0.203	50
31 Milford	4530		Ground	0.440	97
32 Morrow	1600		Ground	0.207	130
33 New Richmond	3500	d,e	Ground	0.240	68
34 South Lebanon	2720	a,b,c,g	Ground	0.320	118
35 Springboro	3000	a,e,g	Ground	0.179	60
36 Waynesville	1800	g	Ground	0.200	110
37 Williamsburg	2200	d	E. Fork Little Miami River	0.100	46
	41880				

Table 4 (Cont'd)

SYSTEM	POPULATION SERVED	UNSATISFACTORY PARAMETERS (see notes)	SOURCE	AVERAGE DAILY DEMAND	WATER USE (GPCD)
Pop. 1000-5000 cont'd					
Indiana					
38 Greendale	3300		Ground	0.360	109
39 North Dearborn	2000		See Greendale	0.055	28
40 Tri-Township	1770		Ground	0.052	29
	7070				
Kentucky					
41 Boone County	4800	h	See Covington	0.220	46
42 Bromley	1130	d,h	See Ludlow	0.070	62
43 Cold Springs	1900	d,f,h	See Covington	0.120	63
44 Highland Heights	4000		See Campbell	0.130	32
45 Silver Grove	1500	b,c,e,g	Ground	0.060	40
46 Taylor Mill	1500	d,h	See Covington	0.060	40
47 Walton	1800	f	Two Lakes	0.100	56
	16630				
	65580				
Population <1000					
Ohio					
48 Epworth Heights	180	a,b,c,d,f	Ground	0.005	27
49 Pennyryl W.D. Warren Co.	990	e	See Springboro	0.026	26
50 Roachstr W.D. Warren Co.	640		See Morrow	0.033	52
51 Twightwee	60	a,c,d,e,f,h	Ground		
	1870				
Indiana					
52 Dillsboro	950	e,f	See Aurora	0.058	61
53 Elrod	520	e,f	See Dillsboro	0.022	42
	1470				

Table 4 (Cont'd)

SYSTEM	POPULATION SERVED	UNSATISFACTORY PARAMETERS (see notes)	SOURCE	AVERAGE DAILY DEMAND	WATER USE (GPCD)
Pop. <1000 cont'd					
Kentucky					
54 Mentor W.D.	650		See Campbell Co.	0.030	46
55 Wilder	650	No sanitary survey made - Source is Covington			
56 Winston Park	800	d,f,h	See Covington	0.040	50
	2100				
	5440				
Special Supplies					
Ohio					
[illegible]on Trailer Park	200	b,f	Ground		
Maple Leaf Mobile Park	200	b,f,h	Ground		
Mobile Manor Trailer Park	100	a,c,d,e,f,h	Ground		
Otterbein Home	260	b,c	Ground		
Shadow Lake Trailer Park	600	a,b,c,f	Ground & Reservoir	0.025	42
Kentucky					
Craig Trailer Park		a,b,f	Ground		
River Ridge Park		e,f	Ground		
Skyline Trailer Park		a,c,d,e,f,h	Ground		

Notes:
a. Inadequate source protection
b. Inadequate treatment capability
c. Low pressure areas
d. Poor maintenance
e. No daily chlorine residuals taken
f. Inadequate frequency of bacteriological sampling
g. Poor bacteriological results
h. Exceed recommended limits

TABLE 5

WATER TREATMENT PRACTICES BY SOURCE

Treatment Practice	Type of System (Number of Systems each)				Overall System Totals	
	Surface Water & Mixed Source	Wells	Wholesale Finished Water Source	Special Systems	Number	Percent
Do not disinfect, clarify, or buy, chlorinated water	0	3	0	4	7	11
Disinfection only or buy chlorinated water	0	8	19	2	29	45
Clarification* and disinfection	8	17	0	2	27	42
Clarification* without disinfection	0	1	0	0	1	2
System Totals - Number	8	29**	19	8	64	100

* Clarification is the removal of suspended material by coagulation, sedimentation and/or filtration.

**National CWSS report shows this number to be 31 due to reporting of the Springboro system as two separate systems and the inclusion of Petersburg Coal Company as a community water supply. Petersburg Coal Company was dropped from the data included in this report as were the other water haulers.

TABLE 6

WATER TREATMENT PRACTICES BY COMMUNITY SIZE

Treatment Practice	Population Served in Thousands (Number of Systems of Each)							Overall System Totals	
	<.5	.5-5	5-10	10-25	25-50	50-100	>100	Number	Percent
Do not disinfect, clarify, or buy chlorinated water	5	2	0	0	0	0	0	7	11
Disinfection only or buy chlorinated water	3	17	4	3	2	0	0	29	45
Clarification* and disinfection	2	12	6	3	2	1	1	27	42
Clarification* without disinfection	0	1	0	0	0	0	0	1	2
System Totals - Number	10**	32**	10	6	4	1	1	64	100

* Clarification is the removal of suspended material by coagulation, sedimentation and/or filtration.

**These numbers were shown in The National CWSS report as 11 and 33 due to reporting of the Springboro system as two separate systems and the inclusion of Petersburg Coal Company as a community water supply. Petersburg Coal Company was dropped from the data included in this report as were the other water haulers.

TABLE 7

FACILITIES EVALUATION BY SOURCE

	Type of System (All data are percent of System Totals)				Overall System Totals	
	Surface Water & Mixed Source	Wells	Wholesale Finished Water Source**	Special Systems	Number	Percent
Essentially Free of Major Deficiencies*	75	45	50	0	28	44
Major Deficiencies	25	55	50	100	35	56
Inadequate source protection (Lacking disinfection or buying inadequately disinfected water)	0	45	11	50	19	30
Inadequate treatment (Lacking disinfection for wells or lacking adequate clarification and/or disinfection for surface supplies)	13	21	N.A.	63	12	19
Low Pressure Areas	0	17	6	50	10	16
System Total - Number	8	29	18	8	63	100

*See page 18

N.A. Not Applicable.

**Wilder not surveyed.

TABLE 8

FACILITIES EVALUATION BY COMMUNITY SIZE

	Population Served in Thousands (All data are percent of Size Totals)							Overall System Totals	
	< .5	.5-5	5-10	10-25	25-30	50-100	>100	Number	Percent
Essentially Free of Major Deficiencies*	0	41	60	33	100	100	100	28	44
Major Deficiencies*	100	59	40	67	0	0	0	35	56
Inadequate Source Protection	55	25	40	33	0	0	0	19	30
Inadequate treatment	55	16	10	17	0	0	0	12	19
Low Pressure Areas	55	13	0	17	0	0	0	10	16
System Totals - Number	9	32**	10	6	4	1	1	63	100

* See page 18

**Wilder not surveyed.

Operation and Surveillance Evaluation: Tables 9 and 10 (See Appendix A, Table III)

The data show that about 1/3 of the systems serving less than 5,000 people have inadequate operation (probably due to the small operating funds available). Only two of the 22 systems serving more than 5,000 people were poorly maintained.

The surveillance of 29 community systems was rated satisfactory with 25 rated unsatisfactory, and two unknown. Daily chlorine residuals were taken by 16 of the 22 systems serving more than 5,000 people and by 11 of the 34 systems serving less than 5,000 people.

Public health surveillance of the water systems was inadequate. Eleven of the 37 source systems had not been recently surveyed. To improve surveillance, increases in the number and depth of regulatory sanitary surveys, improved operator training, and an increase in the number of full-time and certified operators are needed. To achieve the goal of an increased number of sanitary surveys, each of the States need increased funding and numbers of positions within the public water supply programs of the State and local regulatory agencies.

Bacteriological Surveillance: Tables 9 and 10 (See Appendix A, Table IV)

No system serving fewer than 1,000 persons collected adequate bacteriological samples. Seven such systems collected samples less than nine months. Twelve of the 25 systems serving populations between 1,000 and 5,000 persons were not collecting a satisfactory number of samples. Six systems either had collected samples in less than nine of the past 12 months or had no records. Seven of these systems were not maintaining an adequate chlorine residual in the distribution system as determined by the averages of the samples taken during the survey.

Seven of the ten systems serving a population between 5,000 and 10,000 did not collect a sufficient number of bacteriological samples from the distribution system during the past twelve months. One collected samples less than nine months out of the last 12 months. Six were not maintaining an adequate chlorine residual as determined by the average of the samples taken during the survey.

Four of the 12 large systems (over 10,000 population) did not collect an adequate number of samples during the past 12 months. Three of the operators contacted did not know how many months samples had been collected from their distribution systems during the last twelve because they depended upon the sampling program of the system from which they purchased finished water.

A marked lack of attention and effort is directed by the water system operators toward obtaining adequate bacteriological surveillance. This was true for 21 of the systems. None of the systems serving trailer parks and institutions had a satisfactory number of samples collected

Table 9
Operation and Surveillance Evaluation by Source

	Type of System (All data are percent of system totals)				Overall System Totals	
	Surface Water & Mixed Source	Wells	Wholesale Finished Water Source	Special Systems	Number	Percent
Meet bacteriological surveillance and operation criteria	75	24	21	0	17	27
Do not meet bacteriological surveillance and operation criteria	25	76	79	100	47	73
Take less than 70% of recommended # of samples or samples less than 10 months/year	13	34	60	88	29	43
Unsatisfactory sample results for one or more months	13	28	11	0	11	17
Residual chlorine found to be less than 0.1 ppm	13	38	21	25	18	29
Inadequate control of disinfection	0	24	28*	37	15	24
Poor maintenance	13	21	22*	25	13	21
System totals - Number	8	29	19	8	64	100

*Wilder not surveyed

Table 10

Operation and Surveillance Evaluation by Community Size

	Population Served in Thousands (All data are % of Size Totals)							System Overall Totals	
	<.5	.5-5	5-10	10-25	25-50	50-100	>100	Number	Percent
Meet bacteriological surveillance and operation criteria	0	21	10	67	75	100	100	17	
Do not meet bacteriological surveillance and operation criteria	100	79	90	33	25	0	0	47	
Take less than 70% of recommended number of samples or sample less than 10 months per year	100	44	50	0	25	0	0	27	43
Unsatisfactory sample results for one or more months	0	25	30	0	0	0	0	11	17
Residual chlorine found to be less than 0.1 ppm	11	28	60	33	0	0	0	18	29
Inadequate control of disinfection	44	28*	10	17	0	0	0	15	24
Poor maintenance	44	22*	10	17	0	0	0	13	21
System totals - Number	9	33	10	6	4	1	1	64	100

* Wilder not surveyed

for the 12-month period and only one system had collected samples more than six months out of the 12. All of the others had either collected too few or had no records.

Water Quality Evaluation: Tables 11 and 12 (See Appendix A, Tables V, VI)

None of the 64 systems sampled had unsatisfactory quality based on the mandatory limits.

Three of the nine systems serving populations less than 1,000 had finished water quality which exceeded the recommended limits. Five of the 25 systems serving populations between 1,000 and 5,000 had unsatisfactory quality based on recommended limits. The ten systems that each serve populations from 5,000 to 10,000 had three systems for which some constituent exceeded a recommended limit. Ten of the large systems (over 10,000 population) had satisfactory quality based on recommended limits and two had unsatisfactory quality.

Thirteen systems had manganese contents exceeding the limits. Eight of these resulted from one source system which has reportedly corrected this defect through its treatment processes since the survey. The iron limit was exceeded by two systems and the total dissolved solids limit was exceeded by five systems. None of the excessive total dissolved solids exceeded 600 parts per million.

The eight systems serving trailer parks and institutions had satisfactory quality based on mandatory limits. Five had unsatisfactory quality based on recommended limits.

Table 11

Water Quality Evaluation by Source

	Type of System (All data are percent of System Totals)				Overall System Totals	
	Surface Water & Mixed Source	Wells	Wholesale Finished Water Source	Special Systems	Number	Percent
Essentially *meet Constituent Standards	88	76	63	63	46	72
Do not essentially meet Constituent Standards	12	24	37	37	18	28
Exceeds one or more recommended Constituent Standard (some are aesthetic parameters)	12	24	37	37	18	28
Exceeds one or more mandatory Constituent Standard	0	0	0	0	0	0
System Totals - Number	8	29	19	8	64	100

Note: 89 percent of the study population was served drinking water that essentially met the Constituent Standards.

*Average of sample results exceeds Constituent Standards

Table 12

Water Quality Evaluation by Community Size

	Population Served in Thousands (all data are % of Size Totals							System Overall Totals	
	<.5	.5-5	5-10	10-25	25-50	50-100	>100	Number	Percent
Essentially meet Constituent Standards	55	76	60	83	100	0	100	46	72
Do not essentially meet Constituent Standards	45	24	40	17	0	100	0	18	28
Exceeds one or more recommended Constituent Standard (some are aesthetic parameters)	45	24	40	17	0	100	0	18	28
Exceeds one or more mandatory Constituents Standard	0	0	0	0	0	0	0	0	0
System Totals - Number	9	33	10	6	4	1	1	64	100

Note: 89 percent of the study population was served drinking water that essentially met the Constituent Standards.

DISCUSSION

General - The 64 water supply systems surveyed for the community water supply study included 56 community water supply systems and eight special water supply systems. The 56 community water supply systems serve a total of about 1,284,000 people or 91 percent of the total Cincinnati SMSA's population. The service of these systems ranges from the 850,000 people served by the Cincinnati system to the 60 people served by the Twightwee system.

A total of 1,110,000 people (79 percent of the SMSA population and 86 percent of those served by community water supply systems) are served by 20 systems utilizing surface water. Three of the largest systems are using the Ohio River as a source of raw water. The table below shows the number of people served from this source.

Use of the Ohio River

Source System	Retail Service	Wholesale Service	Total
Cincinnati, Ohio	850,000	31,000 (1)	881,000
Covington, Kentucky	64,000	16,790 (7)*	80,790
Newport, Kentucky	35,000	48,650 (3)	83,650
Total	949,000	96,440 (11)	1,045,440

*Includes Wilder

Wholesale service refers to people served by systems purchasing water from the source system. The number of systems are shown in parentheses. The three source systems serve a total of about 1,045,000 people or 74 percent of the SMSA population and 81 percent of those served by community water supply systems. The two other river sub-basins which drain the Cincinnati SMSA are the Little Miami-Great Miami and the Licking - Kentucky - Salt basins. Batavia, Bethel, and Williamsburg draw water from the Little Miami River Basin to serve 7,800 people. Kenton County Water District #1 and Walton draw water from the Licking - Kentucky - Salt system to serve 56,800 people (Florence purchases water from the Kenton system).

Ground water is abundant in the flood plain areas of the SMSA and is, therefore, used by most of the systems serving up to 20,000 people due to the quality and ease of development. Twenty-nine of the 33 systems having a raw water source and serving less than 20,000 people use ground water. About 174,000 people or 14 percent of those served by community water supply systems use ground water supplied by 36 systems.

During periods of low flow both the Ohio and many of its tributaries carry significant pollution concentrations. With the exception of taste and odor causing contaminants, the Ohio River is apparently large enough to provide adequate dilution during periods of normal flow.

With proper flow regulation and secondary sewage treatment of pollution sources, the Ohio River is expected to remain an adequate and relatively good source. The taste and odor so often associated with use of the Ohio River is probably the greatest deterrent to expansion of the Cincinnati service area into areas now served by small systems which utilize ground water. The people served by these small systems seem to be generally well satisfied and proud of their water quality despite the fact that their water cost is higher, maintenance of the systems is poorer, and hazards associated with their use are generally higher. Of course these disadvantages are generally unknown to the public.

In reviewing the data three water haulers and one system serving a light industry were dropped from the data tabulations included in the text of this report as not being appropriate for the definition of public water supply system. The data also showed the Springboro Mill Street Supply to have a per capita use of 29 gallons per day and the Springboro Chautaugua supply to have a per capita use of 118 gallons per day. Since it is highly unlikely that two systems operated in the same area under the same management with no difference in water cost would have such widely different use and since the two systems are known to be separated only by a valve, it has been assumed that the two systems operate as one system. Both systems are, therefore, tabulated as one system. Wilder is not included in the tabulations for sanitary survey data because no sanitary survey was made.

The average water usages per capita per day varied from 26 to 190 gallons and are listed in Table 4, page 24, for each system. Where possible the data was adjusted for industrial use. Lockland and Lebanon show uses of 190 and 160 gallons per capita per day which are considered excessive and probably reflect our inability to deduct industrial use. "Population served" data were checked against estimates available from the Ohio Kentucky Indiana Regional Planning Authority. From this comparison estimates of populations served for Covington, Kenton County, and Newport were revised to 64,000, 40,000, and 35,000 respectively. All estimated usages are high to varying degrees because figures for leakage and commercial and public use were not available for most of the systems.

Evaluation of Systems - Each system was evaluated with regard to source, treatment, distribution system, operation and operators, surveillance, bacteriological quality, and chemical, physical and radiological quality. These determinations are assembled by public water supply systems in Tables II, III, IV, V and VI and are summarized in Table I, Appendix A.

Source - Adequacy of the quantity of raw water available was determined where possible by the maximum dependable draft for ground water supplies and by the safe yield impounded for surface supplies. For most supplies these values were unknown to water supply officials and determination of the adequacy of developed quantity available often depended on the past experience of the operator. Quantity available from the Ohio River was considered unlimited. Table II of Appendix A shows there

appears to be an adequate quantity of both surface and ground water available to the area.

Evaluation of the protection provided to the sources of supply included consideration of administrative control of the watersheds, of impounded waters, discharge of wastes directly into the surface waters near raw water intakes, the location of wells relative to possible pollution sources, and construction details of wells.

In many cases records regarding well construction details did not exist or were not readily available and water supply officials knew very little about the wells in question. For instances where records were not available and water supply officials could not supply any information protection was considered inadequate. Source protection was considered to be a relatively important parameter where the supply did not provide adequate treatment or where plant bypasses were present.

Treatment - Conventional treatment consisting of coagulation, sedimentation, filtration and disinfection is normally considered necessary for the treatment of surface water sources. Treatment for ground water sources normally includes disinfection often coupled with iron removal or hardness removal processes. Because of its importance disinfection was separated from the other treatment processes in Table II. Chlorination was the only means of disinfection employed by the systems surveyed.

Nineteen systems maintain distribution systems and purchase finished water from another system. For example, Dillsboro Water Works, Indiana purchases piped finished water from Aurora Utilities, Indiana. The treatment capacity of such systems was judged to be adequate if the treatment facilities of the source system were adequate. For Dillsboro, the system was judged to have adequate disinfection capacity except for standby equipment. The auxiliary chlorination capabilities were shown to be inadequate because neither Dillsboro nor Aurora, the source, have adequate auxiliary chlorination equipment.

The adequacy of other treatment processes was determined by evaluation of capacities of chemical feeders, detention times, and available volumes versus the average and maximum demands for the supply. This determination was made by the engineer doing the sanitary survey. Surface water supply treatment was judged to be unsatisfactory where inadequate treatment processes or inadequate auxiliary chlorination capacity was provided. Ground water treatment was considered unsatisfactory if the chlorination capacity was inadequate.

Distribution and Finished Water Storage - In the evaluation of the adequacy of the distribution system, finished water storage and pressure were considered. Storage was evaluated on the basis of:

a. A minimum of one day's demand of finished water capable of

flowing into the system by gravity or by use of standby power was deemed necessary in case of an emergency.
b. The storage reservoir should be properly covered, vents screened, and sufficiently inaccessible to protect it from vandalism to reduce the probability of contamination to a minimum.

A minimum pressure of 20 psi in all parts of the distributing system was considered necessary for the pressure to be adequate. Adequate pressure in the distribution pipes reduces chances of contamination by cross-connections and leaks in pipes. The maintenance of adequate pressure in the system was considered the most important parameter for distribution.

Operation and Surveillance - Adequate operation and surveillance is necessary for all water systems to insure the production of potable water and safe delivery to the consumer at all times.

Three items from the sanitary survey were considered to be of primary importance in the evaluation of adequate operation: certification of the operator, presence of a full-time operator, and plant maintenance.

Since programs to eliminate cross-connections and obtain complete chemical analyses are rare for community water supply systems these two factors were given the least weight in judging adequacy of operation and surveillance respectively. Under operation, maintenance as judged by the surveying engineer was considered the most important parameter. Operation was also considered unsatisfactory if a part-time uncertified operator was responsible for running the system.

Surveillance adequacy was judged by frequency of the measurement of chlorine residuals (minimum of daily), chemical analyses performed, and completion of a sanitary survey by the State at least three years prior to the study date.

Under surveillance the most important factor with regard to evaluating the system was the recording of daily chlorine residuals. The taking of daily chlorine residuals is not practiced by many plant operators. This practice was not considered as important if the system purchased water from another system whose operator did record at least daily chlorine residuals.

Bacteriological Evaluations - The three parameters utilized for the bacteriological evaluations were the number of samples collected in the twelve month period preceding the survey, the regularity of sampling and the results of analyses for the aforementioned twelve month period, and results of samples (along with chlorine residuals, if applicable) collected during the sanitary survey.

The minimum number of bacteriological samples to be collected on the distribution system each month is the number recommended as the minimum by the U. S. Public Health Service "Drinking Water Standards." If the total number of bacteriological samples collected during the twelve months preceding the survey was not greater than 69 percent of the

recommended annual minimum, sampling was considered unsatisfactory.

If the system had not collected samples more than eight of the past twelve months or if the results were unsatisfactory one or more of these months the bacteriological evaluation was considered unsatisfactory.

Finally the results of the bacteriological samples collected from the distribution systems and the chlorine residuals, where applicable, were evaluated. None of the samples taken from the distribution system during the study exceeded the Standards. Where inadequate chlorine residual was found for a chlorinated system, the survey results were considered unsatisfactory. A 0.1 mg/l residual for the average of the distribution samples taken was considered the minimum for satisfactory survey results.

Chemical, Physical, and Radiological Analyses - Table V and Table VI list the results of the chemical analyses performed on the samples collected during the survey. All of those constituents for which the "Drinking Water Standards" had either a "recommended limit" or a "mandatory limit" with the exception of phenols, barium, and taste and odor are listed. Boron and certain pesticide (see page 20) analyses were also made. If more than one sample was analyzed for a particular constituent the value listed is the mean value. A dash mark means the result was zero and an X means no analysis was made. The recommended and mandatory limits, as set forth in the "Drinking Water Standards," are shown on the tables.

Only the systems having surface water as a raw water source had samples which were analyzed for either pesticides or by the carbon adsorption method. In some instances, systems purchasing finished water from another system had no radiochemical or wet chemistry analyses performed because it was felt that there would be no change in these constituents once the water was in the distribution system.

Water quality was evaluated using the recommended limits (Tables V and VI) and the mandatory limits (Table VI). If any one constituent exceeded a limit by an amount greater than the degree of accuracy for the analysis, then the quality was considered unsatisfactory.

Waterborne Disease - Individuals contacted in the States of Indiana, Kentucky, and Ohio indicated that they had no records or knowledge of any waterborne disease outbreaks in the Cincinnati SMSA in the past twenty years.

Review of information collected casually by Public Health Service personnel on the subject of waterborne outbreaks occurring in the United States revealed that at least two probable waterborne outbreaks had occurred within the past ten years.

An outbreak of infectious hepatitus occurred in a new federal housing project in Cincinnati in late 1963. Epidemiological data indicated that the outbreak was waterborne.

In early 1964 an elementary school using cisterns for drinking water was closed due to an epidemic of enteric virus. Public health officials believing that the outbreak was caused by contaminated drinking water required reconstruction of the system.

The lack of knowledge within State water supply programs regarding disease outbreaks potentially attributable to water supply systems indicates that mechanisms for bringing such data to the attention of these authorities and for systematically recording such instances are limited.

State Water Supply Programs - The Cincinnati SMSA includes portions of three states, all of which have slightly different water supply programs.

Indiana - Responsibility for the surveillance of public water supply systems is delegated to the Water Supply Section in the Bureau of Environmental Sanitation of the Indiana State Board of Health.

The legal basis for the authority of the Water Supply Section is contained in the Indiana Public Health Code (Acts of 1949, Chapter 157, as amended), the Indiana Conservancy District Act (Acts of 1957, Chapter 308, as amended and supplemented), and the Acts of 1963, Chapter 91, as amended.

The Water Supply Section executes its program from the central office in Indianapolis. There are three men, including the Chief of the Section, who work in the central office. In addition the Section is assisted in field inspections of water by three part-time and one full-time personnel. The three part-time men are professionally trained and handle various activities, such as sewage works inspections and swimming pool inspections and other State environmental health work, in addition to their public water supply inspections. Two of these three men work from their homes and only report in to the central office occasionally. The full-time man was a small water works supervisor for several years, and works from his home reporting regularly to the central office.

Laboratory services are provided by the Water and Sewage Laboratory in the Division of Laboratories. State officials indicated that the Laboratory, although limited in capability, worked very closely with the Water Supply Section.

Activities of the State include in-service training, certification of water works operators, plans review for new construction and improvements to water systems, and providing information for and review and comments on comprehensive basin surveys. Also provided are assessment of damage

and supervision of emergency operation and rehabilitation during periods of disaster.

Certification of water supply operators is voluntary, but is encouraged by the Indiana State Board of Health.

Kentucky - Responsibility for the surveillance of public water supply systems is delegated to the Sanitary Engineering Program in the Division of Environmental Health of the Kentucky Department of Health.

The Sanitary Engineering Program is responsible for the proper design, operation, maintenance and promotion of all municipal water supply systems, including water districts, fluoridation installations, interstate carrier watering points, and public swimming pools. The engineers in the program review plans and specifications on public water supplies and swimming pools; conduct periodic field inspections of these facilities; interpret biological and chemical results of water samples; and evaluate monthly water plant operational reports. The functions of the program are authorized in IRS 211.180 and are delineated in the regulations on Kentucky Public Water Supplies and Fluoridation, and Kentucky Public Swimming Pools.

At the present time the Sanitary Engineering Program is administered through the central office and one district office. Other district offices will be established as soon as funds and manpower are available.

The Sanitary Engineering Program presently includes a director, four engineers, and one assistant. Three of the engineers, the director and the assistant work in and from the central office, while the fourth engineer mans the Western District Office.

All laboratory services are provided by the Division of Laboratories. Certification of water supply operators and fluoridation of systems serving more than 3,000 people is mandatory in the State of Kentucky.

At the present time the program averages 1.2 inspections per system per year. Present program objectives are to provide a minimum of four inspections per system per year. It is felt that such a program will assure proper operation and maintenance of the State's community water supply systems.

Training programs for the water plant operators are sponsored annually by the Sanitary Engineering Program. Regional training schools organized by the Water and Sewage Plant Operators Association are assisted and guided by the engineering staff.

The program is continually upgrading and revising its public water supply and fluoridation regulations, and formulating new policies and procedures consistent with modern trends.

Ohio - Primary responsibility for the surveillance of public water supply systems is delegated to the Water Supply Unit in the Division of Engineering of the Ohio Department of Health.

The Water Supply Unit enforces Sections 3701, Sections 6111, and other related Sections of the Ohio Revised Code pertaining to plans approval, prevention of pollution, and general supervision of 780 community water supply systems. Sixty of these are distribution systems. The Water Supply Unit is responsible for the community water supply system and consults with the General Engineering Unit on semi-public systems. The Unit also consults with the Division of Sanitation on technical aspects of domestic private water supply programs.

Semi-public water supply systems (trailer parks and institutions) fall under the surveillance of county health departments which are certified by the Division of Sanitation. Plans for such systems are reviewed and approved by the General Engineering Unit of the Division of Engineering.

The central office of the Water Supply Unit has one engineer-in-charge, one engineer responsible for operation and maintenance of all supplies, one engineer responsible for all design and plan approvals, and one engineer technician on data processing and special problems. It is estimated that the equivalent of four (4) full-time engineers are available for inspections in the four district offices. State officials estimate this is 50% of the personnel needed to do a fair job of surveillance and promotion. In addition to their own staff the Water Supply Unit utilizes the assistance of county agencies, where qualified personnel are available. Two particular areas where county personnel are used are sample collection and surveillance of large institutions and small community water supply systems.

To provide adequate surveillance of the community water supply systems, State officials believe each system should be inspected at least once per year and more often where problems exist. Approximately 50 percent of the public water supply systems have been inspected each year by State personnel for the last several years, due to a lack of adequate numbers of trained personnel todo the job. This percentage increased to about 80 percent during 1968.

Training of water supply operators at the State level is accomplished through the Operators Training Committee of Ohio and the Certification Advisory Board. Certification of water supply operators is mandatory.

Laboratory services for the Water Supply Unit are provided by the Bureau of Laboratories of the Ohio Department of Health.

Fluoridation - Six systems in the Cincinnati Standard Metropolitan Statistical Area were found to be fluoridating at the time of the field survey. Three of these six systems were selling water to other systems so a total of ten systems were providing fluoridated water to their consumers.

SYSTEM	ESTIMATED POPULATION
Aurora Utilities, Indiana	6,300
*Dillsboro Water Works, Indiana	950
*Elrod Water Corporation, Indiana	520
**Florence Water & Sewer Commission, Ky.	15,000
Glendale Water Works, Ohio	3,000
Greendale Utilities, Indiana	3,300
Indian Hill Water Works, Ohio	15,000
Kenton County Water District #1, Ky.	40,000
***North Dearborn Water District, Indiana	2,000
Wyoming Water Works Ohio	10,000
Total Population	96,070

*Aurora Utilities water
**Kenton County Water District #1 water
***Greendale Utilities, water

The population receiving fluoridated water represents approximately 7% of the population of the SMSA or 8% of the population served by community water supply systems.

The Public Health Service "Drinking Water Standards," (1962 revision) recommend a fluoride content range from 0.7 to 1.2 mg/l, based on a mean maximum daily temperature of 66.1°F. The recommended fluoride concentration varies with temperature because the average person's water intake varies with the temperature.

Only three of the 20 samples collected from the ten systems providing fluoridated water were not within the recommended limits (all three were low).

An additional six systems indicated their water contained a certain amount of natural fluorides. Two of these six systems sell water to other systems, therefore, eight systems were aware that the water they were providing to their consumers contained small amounts of natural fluoride.

Table 13 - Natural Fluoride in Water Supplies

SYSTEM	MEASURED F LEVEL	INDICATED F LEVEL	ESTIMATED POPULATION
Batavia	0.17 ppm	0.2 ppm	2,200
Cincinnati	0.20 ppm	0.2 ppm	860,000
Lebanon	0.31 ppm	0.6 ppm	6,400
*Lebanon-Franklin Water District	0.36 ppm	0.6 ppm	4,000
**Norwood		0.2 ppm	41,000
South Lebanon	0.15 ppm	0.6 ppm	2,700
Waynesville	0.17 ppm	0.2 ppm	1,800
Williamsburg	0.14 ppm	0.2 ppm	2,000
Total			920,100

*Purchase finished water from Lebanon
**Purchase finished water from Cincinnati

The total population served by the above listed systems represents 64% of the SMSA or 70% of those served by community water supply systems. The fluoride concentration found in the samples collected during the survey approximated that indicated by the water supply officials except for Lebanon and South Lebanon, Ohio. The fluoride concentration found in the samples collected during the survey was considerably lower than the concentration indicated in each case.

The results from the chemical analysis performed on the samples, collected during the survey (Table VI) indicated that every system surveyed produced water containing a small amount of fluoride (0.09 - 0.31 ppm)

None of the sources for the systems surveyed in the Cincinnati SMSA have a natural fluoride content in excess of 0.4 ppm. There is, therefore, no need for any of the systems to practice defluoridation. On the other hand no supply had natural fluoride present in the optimum range. The addition of small amounts of fluoride is, therefore, desirable to raise the fluoride levels to this optimum range.

Fluoridation Law - The State of Ohio has enacted a fluoridation law titled, "Ohio Statewide Fluoridation Act." This fluoridation law became effective November 19, 1969. The law states that the fluoride content of the water shall not be less than 0.8 ppm or greater than 1.3 ppm. The plan for implementation is that systems serving 20,000 or more persons and having a natural fluoride content less than 0.8 ppm shall commence fluoridation not later than January 1, 1971. Systems serving 5,000 but less than 20,000 people and having a natural fluoride content of less than 0.8 ppm shall be practicing fluoridation not later than January 1, 1972. Though fluoridation is not mandatory for systems serving fewer than 5,000 people, it is encouraged.

The Indiana State Board of Health has gone on record as favoring fluoridation of public water supply systems. Their regulations are set forth in a document entitled, "Policy and Standards for Fluoridation of Public Water Supplies." They recommend a fluoride concentration of 1.0 ppm.

The Kentucky Department of Health has a law which makes fluoridation mandatory for public water supply systems serving more than 3,000 people. This law became effective July 22, 1966 and recommends an optimum fluoride content of 1.2 ppm, with limits of 1.0 ppm to 1.5 ppm. Two of the systems surveyed during the study, Covington Municipal Water Supply serving 64,000 people and Newport Municipal Water Supply serving 35,000 people, were not in compliance with this fluoridation law.

Cross-Connection Control - A community water supply system was judged to have an adequate cross-connection control program if:

1) The community had a plumbing code or other regulations prohibiting connections or arrangements by which liquids, streams, waters, gases, or chemicals of unsafe, unknown or questionable quality may be discharged or drawn into the public water supply.

2) There is a continuous cross-connection survey program, providing for periodic reinspection of potentially hazardous places, to detect health hazards and sanitary defects within the water distribution system.

Only one of the 56 community water supply systems surveyed during the study was found to have a continuous cross-connection control program.

The other 55 community water supply systems had a partial cross-connection control program. That is, they had proper regulations and someone, usually a building inspector, performed a plumbing inspection on new construction or major remodeling. However, there were no periodic reinspections.

In connection with the study a special cross-connection investigation was conducted in each system serving more than 100,000 people or one in each of the nine study areas. In the Cincinnati SMSA such investigations were conducted in the Cincinnati, Ohio system and the Covington, Kentucky system. It was later learned that Covington did not serve over 100,000 people. The results of the two investigations were as follows:

Cincinnati, Ohio - A continuous program to detect health hazards and sanitary defects within this distribution system does not exist. Inspection by city building department authorities was on new construction only. The plumbing inspection department was under-staffed.

None of the present inspectors have received any specialized training in the detection or prevention of cross-connections. From the number of hazards observed during this brief investigation, the lack of a cross-connection control program must be judged a deficiency. Much more emphasis is needed.

Covington, Kentucky - The contact in this survey was the county health officer. No specific cross-connection control program existed within the water department or the local health department. The health officer contacted had many varied responsibilities, including all aspects of plumbing. The Kentucky State Plumbing Law, Regulations and Code has been adopted by the health department, but available staff is inadequate to promote a satisfactory program. The hazards detected during the inspection were indicative of the need for a cross-connection control program.

Reported Complaints - Table 14 shows the consumer's complaints that were cited by the system operators as most often occurring.

Table 14 - Primary Customer Complaints

Complaints	Systems
Chlorine (5) and other taste and odor	15
High water rates	13
Colored water due to iron	7
Incorrect billing	5
Main breaks	2
Hardness	2
Turbidity	2
Low pressure	1

Excluding the five systems citing taste and odor complaints related to the use of chlorine, the taste and odor complaint was the primary complaint for 10 systems, more than any other water quality related complaint. This was to be expected since the reason for choosing the Cincinnati SMSA as a study area was its past history of organics and odor problems. It is interesting to note that five of the systems naming taste and odor complaints used surface sources and five used ground water sources. Every system (3) using the Ohio River cited taste and odor as the primary complaint. Use of the East Fork of the Little Miami River produced most complaints for one system. A system served by two small lakes also cited taste and odor complaints. Two of the five ground water systems citing taste and odor complaints, had a mineral content which exceeded recommended limits, iron for one and manganese for the other. It is probable that the taste and odor problems in the ground water were caused by minerals, though this was not substantiated. Tastes and odors, though sometimes quite troublesome, can usually be decreased or eliminated by proper treatment. The primary consideration about tastes and odors from a health standpoint is that consumers may reject a safe, yet undesirable water, for one that is unsafe but less objectionable aesthetically.

Seven systems cited complaints about the quantity of iron in the water as being most prevalent. None of the systems citing consumer complaints about iron had excessive (greater than 0.3 mg/l) iron in the samples collected during the survey. This indicates the complaints resulted from lack of corrosion control. Iron often imparts an objectionable taste to the water and can stain both laundry and fixtures. The amount of iron in water likely to cause objectionable taste or laundry staining (as much as 0.3 mg/l) constitutes only a small fraction of the amount normally consumed and isn't likely to have a toxicological effect. Methods of treatment for iron removal and corrosion control are available.

Other water quality related complaints cited as most prevalent were about hardness (2) and turbidity (2). The total number of systems citing water quality complaints as being most prevalent was 26.

Systems citing complaints about high water rates totaled thirteen (13). There seemed to be no correlation between the actual rates and such complaints because some of the systems having very low rates cited such complaints as being most prevalent. Of course, the manner in which data on most prevalent complaints were collected (asking the operator what the most prevalent complaint by the consumers was) gives the data no statistical significance. In general, however, the data regarding the status of the water works facilities in the Cincinnati SMSA indicate that more funds should be made available to public water supply systems for improvement.

APPENDIX A

TABLES OF RESULTS BY SYSTEMS

Table I - Evaluation of Systems

Water Systems	Table II			Table II		Table IV			Table V & Table VI		
						12 mo. record					
Population > 10,000	Source	Treatment	Distribution	Operation	Surveillance	Number Collected	Results	Survey Results	Mandatory Chemicals	Recommended incl. Rad.	Physical
Ohio											
Cincinnati	S	S	S	S	S	S	S	S	S	S	S
Franklin	S	U	S	S	S	S	S	U	S	S	S
Indian Hill	S	S	S	S	S	S	S	S	S	S	S
Miami-Goshen-Stonelick	U	S	S	S	U	S	S	S	S	S	S
Norwood	S	S	S	S	S	S	S	S	S	S	S
Pierce-Union-Batavia	S	S	S	S	S	S	S	S	S	S	S
Reading	U	S	S	U	S	S	S	U	S	U	S
Kentucky											
Campbell Co. W. D. #1	S	S	S	S	U	U	S	S	S	S	S
Covington	S	S	S	S	S	S	S	S	S	S	S
Florence	U	S	U	S	U	S	S	S	S	U	S
Kenton Co. W. D. #1	U	S	S	S	S	S	S	S	S	S	S
Newport	S	S	S	S	S	S	S	S	S	S	S

Table I - Evaluation of Systems

Water Systems	Table II			Table III		Table IV			Table V & Table VI		
						12 mo. record					
5000 < population < 10000	Source	Treatment	Distribution	Operation	Surveillance	Number Collected	Results	Survey Results	Mandatory Chemicals	Recommended incl. Rad.	Physical
Ohio											
Fairfield-Hamilton [illegible]	U	S	S	S	S	S	U	U	S	S	S
Harrison	U	S	S	S	S	U	S	U	S	U	S
Lebanon	U	S	S	U	U	U	S	U	S	S	S
Lockland	S	S	S	S	S	S	S	S	S	S	S
Loveland	U	U	S	S	S	U	S	U	S	S	S
Mason	U	S	S	S	S	S	U	S	S	S	S
Wyoming	U	S	S	S	S	S	S	U	S	S	S
Indiana											
Aurora	S	S	S	S	S	U	S	S	S	S	S
Lawrenceburg	S	S	S	S	S	U	U	S	S	U	S
Kentucky											
Ludlow	S	S	S	S	U	S	S	U	S	U	S

Table I - Evaluation of Systems

Water Systems	Table II			Table III		Table IV			Table V & Table VI		
						12mo. record					
1000 < population ≤ 5000	Source	Treatment	Distribution	Operation	Surveillance	Number Collected	Results	Survey Results	Mandatory Chemicals	Recommended incl. Rad.	Physical
Ohio											
Addyston	U	S	S	U	U	S	U	S	S	S	S
Batavia	S	S	S	S	S	S	S	S	S	S	S
Bethel	S	U	S	S	S	S	U	S	S	S	S
Cleves	S	S	S	S	S	S	S	S	S	S	S
Felicity	U	U	U	U	U	U	S	S	S	U	S
Franklin W.D.	S	U	S	S	U	S	S	U	S	S	S
Glendale	U	S	S	U	S	U	S	U	S	S	S
Lebanon Franklin W.D.	U	S	S	S	U	S	S	U	S	S	S
Milford	S	S	S	S	S	S	S	S	S	S	S
Morrow	S	S	S	S	S	S	S	S	S	S	S
New Richmond	S	S	S	U	U	S	U	U	S	S	S
South Lebanon	U	U	U	S	S	S	U	U	S	S	S
Springboro	U	S	S	S	U	S	U	U	S	S	S
Waynesville	S	S	S	S	S	S	S	S	S	S	S
Williamsburg	S	S	S	U	S	S	S	S	S	S	S
Indiana											
Greendale	U	S	S	S	S	S	S	S	S	S	S
North Dearborn	U	S	S	S	U	S	U	S	S	S	S
Tri Township	U	S	S	U	S	S	S	S	S	S	S
Kentucky											
Boone Co. W.D.	S	S	S	S	U	U	S	S	S	U	S
Bromley	S	S	S	U	U	S	S	S	S	U	S
Cold Springs	S	S	S	U	U	U	S	S	S	U	S
Highland Heights	S	S	S	U	U	U	U	S	S	S	S
Silver Grove	S	U	S	U	S	S	U	S	S	S	S
Taylor Mill	S	S	S	U	U	U	S	S	S	U	S
Walton	S	S	S	S	S	U	S	U	S	S	S

Table I - Evaluation of Systems

Water Systems	Table II			Table III		Table IV			Table V & Table VI		
Population < 1000	Source	Treatment	Distribution	Operation	Surveillance	Number Collected	Results	Survey Results	Mandatory Chemicals	Recommended incl. Rad.	Physical
Ohio											
[illegible] Heights	U	U	U	U	S	U	-	S	S	S	S
[illegible]royal W.D.	U	S	S	S	U	S	S	S	S	S	S
[illegible] Water W.D.	S	S	S	S	U	U	S	U	S	S	S
Twightwee	U	S	U	U	U	U	-	S	S	U	S
Indiana											
Dillsboro	S	S	S	S	U	U	S	S	S	S	S
Elrod	S	S	S	S	U	S	S	S	S	S	S
Kentucky											
Mentor W.D.	S	S	S	S	U	U	-	S	S	S	S
Wilder						U	-	S	S	U	S
Winston Park	S	S	S	U	U	U	-	S	S	U	S

Appendix A

Table I - Evaluation of Systems

Special Systems	Table II			Table III		Table IV			Table V & Table VI		
	Source	Treatment	Distribution	Operation	Surveillance	Number Collected	Results	Survey Results	Mandatory Chemicals	Recommended Incl. Rad.	Physical
Ohio											
Lotton	S	U	S	U	S	U	-	S	S	S	S
Maple Leaf	S	U	S	U	S	U		S	S	U	S
Mohr's Manor	U	S	U	U	U	U	-	U	-	U	-
Ottershein Home	S	U	U	U	S	S	S	S	S	S	S
Shadow Lake	U	S	U	U	U	U	-	U	S	S	S
Kentucky											
Craig Trailer Park	U	U	S	U	S	U	-	S	S	S	S
River Ridge Park	S	S	S	S	U	U	S	S	S	S	S
Skyline Trailer Park	U	U	U	U	U	U	S	S	S	U	U

Table II Facilities Appraisal

Population ≥ 10000	Source			Treatment				Distribution		
				Processes	Chlorination		Rating			
	Quant.	Protect.	Rating		Cap.	Auxil.		Storage	Pressure	Rating
Ohio										
Cincinnati	A	A	S	A	A	A	S	A	A	S
Franklin	A	A	S	None	I	None	U	A	A	S
Indian Hill	A	A	S	A	A	None	S	A	A	S
Miami-Goshen-Stonelick	A	I	U	None	A	None	S	A	A	S
Norwood	Cincinnati							A	A	S
Pierce-Union-Batavia	A	A	S	A	A	A	S	A	A	S
Reading	I	I	U	I	A	None	S	A	A	S
Kentucky										
Campbell Co. W.D. #1	Newport							A	A	S
Covington	A	A	S	A	A	A	S	A	A	S
Florence	Kenton County Water District #1							A	I	U
Kenton Co. W.D. #1	A	I	U	A	A	A	S	A	A	S
Newport	A	A	S	A	A	A	S	I	A	S

Table II Facilities Appraisal

5000 < Population ≤ 10000	Source			Treatment				Distribution		
				Processes	Chlorination		Rating			
	Quant.	Protect.	Rating		Cap.	Auxil.		Storage	Pressure	Rating
Ohio										
Deerfld.-Hamilton W.D.	A	I	U	A	A	I	S	A	A	S
Harrison	A	I	U	None	A	None	S	I	A	S
Lebanon	I	I	U	I	A	None	S	I	A	S
Lockland	A	A	S	A	A	None	S	A	A	S
Loveland	A	I	U	None	I	I	U	I	A	S
Mason	A	I	U	A	A	None	S	A	A	S
Wyoming	A	I	U	I	A	None	S	A	A	S
Indiana										
Aurora	A	A	S	None	A	I	S	A	A	S
Lawrenceburg	A	A	S	A	A	None	S	A	A	S
Kentucky										
Ludlow	Covington ----------							I	A	S

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Table II Facilities Appraisal

1000 > Population < 5000	Source			Treatment				Distribution		
				Processes	Chlorination		Rating			
	Quant.	Protect.	Rating		Cap.	Auxil.		Storage	Pressure	Rating
Ohio										
Addyston	A	I	U	None	A	None	S	A	A	S
Batavia	A	A	S	A	A	A	S	I	A	S
Bethel	A	A	S	I	A	None	U	I	A	S
Cleves	A	A	S	A	A	A	S	I	A	S
Felicity	A	I	U	None	None	None	U	A	I	U
Franklin W.D.	Franklin							A	A	S
Glendale	A	I	U	I	A	None	S	A	A	S
Lebanon-Franklin W.D.	Lebanon							A	A	S
Milford	A	A	S	A	A	None	S	A	A	S
Morrow	A	A	S	A	A	A	S	I	A	S
New Richmond	A	A	S	I	A	None	S	I	A	S
South Lebanon	A	I	U	None	None	None	U	A	I	U
Springboro	A	I	U	I	A	A	S	A	A	S
Waynesville	A	A	S	None	A	A	S	I	A	S
Williamsburg	A	A	S	A	A	A	S	A	A	S
Indiana										
Greendale	A	I	U	A	A	A	S	A	A	S
North Dearborn	Greendale							A	A	S
Tri-Township	A	I	U	A	A	None	S	A	A	S
Kentucky										
Boone Co. W.D.	Covington							A	A	S
Bromley	Ludlow							A	A	S
Cold Springs	Covington							I	A	S
Highland Heights	Campbell County W.D. #1							A	A	S
Silver Grove	A	A	S	I	None	None	U	A	I	U
Taylor Mill	Covington							U	A	S
Walton	A	A	S	A	A	A	S	A	A	S

Appendix A

Table II - Facilities Appraisal

Population < 1000	Source			Treatment				Distribution		
				Processes	Chlorination		Rating			
	Quant.	Protect.	Rating		Cap.	Auxil.		Storage	Pressure	Rating
Ohio										
Epworth Heights	A	I	U	None	None	None	U	I	I	U
Pennyroyal W.D.	Springboro							A	A	S
Roachester W.D.	Morrow							A	A	S
Twightwee	A	I	U	None	A	A	S	A	I	U
Indiana										
Dillsboro	Aurora							A	A	S
Elrod	Dillsboro & Milan							A	A	S
Kentucky										
Mentor W.D.	Campbell County W.D. #1							A	A	S
Wilder	Covington							No Survey		
Winston Park	Covington							A	A	S
SPECIAL SYSTEMS										
Ohio										
Lotton	A	A	S	None	None	None	U	A	A	S
Maple Leaf	A	A	S	None	None	None	U	A	A	S
Mobile Manor	A	I	U	A	A	None	S	A	I	U
Otterbein Home	A	A	S	None	None	None	U	A	I	U
Shadow Lake	I	I	U	I	A	A	S	A	I	U
Kentucky										
Craig Trailer Park	A	I	U	None	None	None	U	A	A	S
River Ridge Park	A	A	S	None	A	None	S	A	A	S
Skyline Trailer Park	A	I	U	None	I	None	U	A	I	U

Table III - Operation and Surveillance

Water System Population > 10000	Operator Certified	Operator Full-Time	Cross-Connection Control	Maintenance Adequate	Rating	Daily Cl_2 Residual	Chemical Analysis	Sanitary Survey	Rating
Ohio									
Cincinnati	X	X	No	X	S	X	X	X	S
Franklin	No	X	No	X	S	X	No	X	S
Indian Hill	X	X	No	X	S	X	X	No	S
Miami-Goshen-Stonelick	No	X	No	X	S	No	X	X	U
Norwood	Cincinnati		No	-	-	No	X	-	U
Pierce-Union-Batavia	X	X	No	X	S	X	No	X	S
Reading	X	X	No	No	U	X	No	No	S
Kentucky									
Campbell Co. W.D. #1	Newport		No	X	S	No	No	-	U
Covington	X	X	No	X	S	X	X	X	S
Florence	Kenton		No	X	S	No	X	No	U
Kenton Co. W.D. #1	X	X	No	X	S	X	X	X	S
Newport	X	X	X	X	S	X	No	X	S
5000<population<10000									
Ohio									
Deerfield-Hamilton W.D.	X	X	No	X	S	X	No	X	S
Harrison	No	X	No	X	S	X	No	X	S
Lebanon	X	No	No	No	U	No	No	X	U
Lockland	X	X	No	X	S	X	No	No	S
Loveland	No	X	No	X	S	X	No	X	S
Mason	X	X	No	X	S	X	No	No	S
Wyoming	X	X	No	X	S	X	No	X	S
Indiana									
Aurora	No	X	No	X	S	X	X	No	S
Lawrenceburg	X	X	No	X	S	X	No	No	S
Kentucky									
Ludlow	Covington		No	X	S	No	X	-	U

Table III - Operation and Surveillance

Water System Population	Operator Certified	Operator Full-Time	Cross Connection Control	Maintenance Adequate	Rating	Daily Cl_2 Residual	Chemical Analysis	Sanitary Survey	Rating
Ohio									
Addyston	No	No	No	X	U	No	No	X	U
Batavia	X	X	No	X	S	X	No	X	S
Bethel	X	X	No	X	S	X	X	X	S
Cleves	X	X	No	X	S	X	No	X	S
Felicity	No	No	No	X	U	No Cl_2	No	X	U
Franklin W.D.	Franklin		No	X	S	No	No	-	U
Glendale	X	X	No	No	U	X	No	X	S
Lebanon-Franklin W.D.	Lebanon		No	X	S	No	No	-	U
Milford	X	X	No	X	S	X	No	X	S
Morrow	X	X	No	X	S	X	No	X	S
New Richmond	X	X	No	No	U	No	No	X	U
South Lebanon	No	X	No	X	S	No Cl_2	X	No	S
Springboro	X	No	No	X	S	No	No	No	U
Waynesville	No	X	No	X	S	X	No	X	S
Williamsburg	X	X	No	No	U	X	No	X	S
Indiana									
Greendale	No	X	No	X	S	X	No	X	S
North Dearborn	Greendale		No	X	S	No	No	-	U
Tri Township	No	No	No	X	U	X	No	X	S
Kentucky									
Boone Co. W.D.	Covington		No	X	S	No	X	-	U
Bromley	Ludlow		No	No	U	No	X	-	U
Cold Springs	Covington		No	No	U	No	X	-	U
Highland Heights	Campbell Co.		No	X	S	No	No	-	U
Silver Grove	No	X	No	No	U	No Cl_2	No	X	S
Taylor Mill	Covington		No	No	U	No	X	-	U
Walton	X	X	No	X	S	X	No	No	S

Appendix A

Table III - Operation and Surveillance

Water System Population < 1000	Operator Certified	Operator Full-Time	Cross-Connection Control	Maintenance Adequate	Rating	Daily Cl_2 Residual	Chemical Analysis	Sanitary Survey	Rating
Ohio									
Brywonk Heights	No	No	No	No	U	No Cl_2	No	X	S
Pennyroyal M.P.	Springboro		No	X	S	No	No	-	U
Roachester M.P.	Morrow		No	X	S	No	No	-	U
Twightwee	No	No	No	No	U	No	No	No	U
Indiana									
Dillsboro	Aurora		No	X	S	No	X	-	U
Elrod	Dillsboro		No	X	S	No	X	-	U
Kentucky									
Manton M.P.	Campbell Co.		No	X	S	No	No	-	U
Milsap	No survey made								
Winston Park	Covington		No	No	U	No	X	-	U
SPECIAL SURVEYS									
Ohio									
Lotton	No	No	No	X	U	No Cl_2	No	No	S
Maple Leaf	No	No	No	X	U	No Cl_2	No	No	S
Mobile Manor	No	No	No	X	U	No	No	No	U
Otterbein Home	No	No	No	X	U	No Cl_2	No	X	S
Shadow Lake	No	No	No	X	U	X	No	X	S
Kentucky									
Craig Trailer Park	No	No	No	X	U	No Cl_2	No	X	S
River Ridge Park	No	X	No	X	S	No	No	X	U
Skyline Trailer Park	No	X	No	No	U	No	No	X	U

Table IV Bacteriological Evaluation of Finished Water

Water System Population > 10000	12 months of record					Survey Results		
	Recommended Samples Taken #	Months Samples Collected	Rating	Months Samples Unsatisfactory	Rating	Samples Unsatisfactory # taken	Residual Chlorine	Rating
Ohio								
Cincinnati	108	12	S	0	S	0 (30)	0.4	S
Franklin	149	12	S	0	S	0 (2)	Trace	U
Indian Hill	330	12	S	0	S	0 (2)	0.3	S
Miami-Goshen-Stonelick	93	11	S	0	S	0 (2)	0.3	S
Norwood	Cincinnati		-	-	-	-	-	-
Pierce-Union-Batavia	100	11	S	0	S	0 (2)	0.2	S
Reading	86	12	S	0	S	0 (2)	<.1	U
Kentucky								
Campbell Co. W.D. #1	40	12	U	0	S	0 (4)	1.1	S
Covington	177	12	S	0	S	0 (2)	0.8	S
Florence	70	12	S	0	S	0 (2)	2.0	S
Kenton Co. W.D. #1	195	12	S	0	S	0 (6)	1.6	S
Newport	240	12	S	0	S	0 (6)	1.2	S

Table IV Bacteriological Evaluation of Finished Water

Water System 5000 < population ≤ 10000	12 months of record					Survey Results		
	Recommended Samples Taken #	Months Samples Collected	Rating	Months Samples Unsatisfactory	Rating	Samples Unsatisfactory # taken	Residual Chlorine	Rating
Ohio								
Deerfield-Hamilton T.D.	[illegible]	12	S	1	U	0 (2)	Trace	U
Harrison	57	12	U	0	S	0 (2)	< 0.1	U
Lebanon	3	3	U	0	S	0 (2)	0	U
Lockland	146	11	S	0	S	0 (2)	-	S
Loveland	35	12	U	0	S	0 (2)	0	U
Mason	96	10	S	1	U	0 (2)	0.1	S
Wyoming	170	12	S	0	S	0 (2)	0	U
Indiana								
Aurora	62	12	U	0	S	0 (2)	1.1	S
Lawrenceburg	69	12	U	1	U	0 (2)	0.8	S
Kentucky								
Ludlow	143	12	S	0	S	0 (2)	0	U

Table IV Bacteriological Evaluation of Finished Water

Water [illegible] 1000 < population ≤ [illegible]	12 months of record					Survey Results		
	Recommended Samples Taken #	Months Samples Collected	Rating	Months Samples Unsatisfactory	Rating	Samples Unsatisfactory # taken	Residual Chlorine	Rating
Ohio								
Addyston	91	12	S	1	U	0 (2)	-	S
Batavia	229	12	S	0	S	0 (2)	0.3	S
Bethel	260	12	S	1	U	0 (2)	0.3	S
Cleves	94	12	S	0	S	0 (2)	0.1	S
Felicity	29	2	U	0	S	0 (2)	-	S
Franklin W.D.	79	9	S	0	S	0 (2)	0	U
Glendale	42	9	U	0	S	0 (2)	0	U
Lebanon-Franklin W.D.	100	10	S	1	U	0 (2)	0	U
Milford	~~382~~	~~12~~	~~S~~	0	S	0 (2)	<0.1	U
Morrow	200	12	S	0	S	0 (1)	<0.1	U
New Richmond	90	12	S	0	S	0 (2)	Trace	U
South Lebanon	256	12	S	3	U	0 (3)	-	S
Harrisburg	100	12	S	2	U	0 (4)	-	S
Lynchville	100	12	S	2	U	0 (2)	0.7	S
Williamsburg	250	12	S	0	S	0 (2)	1.2	S
Indiana								
Greendale	125	12	S	0	S	0 (2)	1.3	S
North Dearborn	104	10	S	1	U	0 (2)	1.1	S
Tri-Township	212	12	S	0	S	0 (2)	0.3	S
Kentucky								
Boone Co. W.D.	150	5	U	0	S	0 (2)	0.1	S
Bromley	71	12	S	0	S	0 (2)	0.2	S
Cold Springs	0	0	U	-	-	0 (2)	1.1	S
Highland Heights	0	0	U	-	-	-	-	-
Silver Grove	71	10	S	1	U	0 (2)	-	S
Taylor Mill	292	6	U	0	S	0 (2)	0.2	S
Walton	63	9	U	0	S	0 (2)	0	U

Appendix A

Table IV Bacteriological Evaluation of Finished Water

Water System Population <1000	12 months of record					Survey Results		
	Recommended Samples Taken %	Months Samples Collected	Rating	Months Samples Unsatisfactory	Rating	Samples Unsatisfactory # taken	Residual Chlorine	Rating
Ohio								
Epworth Heights	0	0	U	-	-	0 (2)	-	S
Pennyroyal W.D.	79	12	S	0	S	0 (2)	0.2	S
Roachester W.D.	50	12	U	0	S	0 (2)	Trace	U
Twightwee	0	0	U	-	-	0 (2)	0.3	S
Indiana								
Dillsboro	16	4	U	0	S	0 (2)	1.0	S
Floyd	75	9	S	0	S	0 (2)	0.7	S
Kentucky								
Mentor W.D.	0	0	U	-	-	0 (2)	0.8	S
Wilder	0	0	U	-	-	0 (1)	0.9	S
Winston Park	0	0	U	-	-	0 (2)	0.3	S
SPECIAL SYSTEMS								
Ohio								
Lotton	0	0	U	-	-	0 (2)	-	S
Maple Leaf	0	0	U	-	-	0 (2)	-	S
Mobile Manor	0	0	U	-	-	0 (2)	0	U
Otterbein Home	71	10	S	0	S	0 (2)	-	S
Shadow Lake	0	0	U	-	-	0 (2)	0	U
Kentucky								
Craig Trailer Park	0	0	U	-	-	0 (1)	-	S
River Ridge Park	42	4	U	0	S	0 (2)	-	S
Skyline Trailer Park	17	4	U	0	S	0 (2)	-	S

Ba not done
Threshold Odor not done
- means results = 0, X means samples not run

Table V Mandatory & Physical Limits

No sample exceeded the mandatory limit of 1.4 for F.

Water System	Cr 0.05	Ag 0.05	Se 0.01	As 0.05	Pb 0.05	Cn 0.2	Cd .01	F 5.0	Rating	Color 15	Turb 5	Rating
Population >10000												
Ohio												
Cincinnati	.009	-	.004	-	.012	-	.001	-	S	-	.1	S
Franklin	.030	.001	.003	-	.011	-	.001	.23	S	-	.1	S
Indian Hills	.025	.001	.002	-	.025	-	.004	-	S	-	.2	S
Miami-Goshen-Stonelick	-	-	.002	-	.022	-	-	.10	S	-	.2	S
Norwood	.009	-	.004	-	.012	-	.001	-	S	-	.1	S
Pierce-Union-Batavia	.023	.002	.002	-	.019	-	.002	.22	S	-	.5	S
Reading	-	.001	.002	-	.009	-	-	.15	S	-	.1	S
Kentucky												
Campbell Co. W.D. #1	.004	.003	.007	-	.006	.004	.001	-	S	-	1.3	S
Covington	-	-	.007	-	.008	-	-	-	S	-	.4	S
Florence	.015	.001	.005	0	.012	-	-	-	S	-	.1	S
Kenton Co. W.D. #1	.012	.001	.005	-	.009	-	-	-	S	-	.1	S
Newport	.005	-	.005	-	.005	-	-	-	S	-	.5	S
5000<Population≤10000												
Ohio												
Deerfield Hamilton W.D.	-	-	.002	-	.014	-	.001	.23	S	-	.3	S
Harrison	-	-	.002	-	.023	-	.001	-	S	-	1.2	S
Lebanon	.013	-	.002	-	.023	-	.003	-	S	-	.1	S
Lockland	-	-	.002	-	.011	-	.001	.11	S	-	.1	S
Loveland	.012	.001	.003	-	.021	-	.002	-	S	-	.1	S
Mason	-	-	.002	-	.011	-	.001	-	S	-	.1	S
Wyoming	.012	-	.003	-	.014	-	-	.10	S	-	.2	S
Indiana												
Aurora	.013	-	.004	-	.008	-	.001	-	S	-	.1	S
Lawrenceburg	-	-	.002	-	.003	-	-	.15	S	-	.1	S
Kentucky												
Ludlow	-	-	.007	-	.007	-	-	-	S	-	.4	S

Table V Mandatory & Physical Limits

Water System	Cr	Ag	Se	As	Pb	Cn	Cd	B	Rating	Color	Turb	Rating
	0.05	0.05	0.01	0.05	0.05	0.2	.01	5.0		15	5	
1000<Population≤5000												
Ohio												
Addyston	.021	-	.002	-	.004	-	-	-	S	-	.2	S
Batavia	-	.002	.004	-	.001	-	.001	-	S	-	.1	S
Bethel	-	.002	.009	-	.015	.003	.002	-	S	-	.9	S
Cleves	-	-	.002	-	.019	-	.001	.14	S	-	1.0	S
Felicity	.022	-	.003	-	.007	-	.002	-	S	-	1.0	S
Franklin W.D.	-	-	.003	-	.024	-	.001	.23	S	-	.1	S
Glendale	.009	-	.003	-	.005	-	.002	-	S	-	.2	S
Lebanon Franklin W.D.	-	.001	.002	-	.024	-	.002	-	S	-	.1	S
Milford	-	.002	.003	-	.009	-	.001	-	S	-	.2	S
Morrow	-	.002	.002	-	.026	-	.003	.13	S	-	.3	S
New Richmond	-	.001	.002	-	.005	-	.001	-	S	-	.2	S
South Lebanon	.013	-	.002	-	.021	.007	.002	.14	S	-	.3	S
Springboro	.026	.002	.002	-	.009	-	.002	.09	S	-	1.2	S
Waynesville	.013	.002	.003	-	.012	-	.001	-	S	-	.1	S
Williamsburg	.016	-	.006	-	.012	-	.002	-	S	-	.9	S
Indiana												
Greendale	-	.001	.002	-	.004	.003	-	-	S	-	.2	S
North Dearborn	-	-	.002	-	-	.003	-	-	S	-	.2	S
Tri-Township	-	.001	.002	-	.009	-	.002	.1	S	-	.1	S
Kentucky												
Boone County W.D.	.022	.001	.003	-	.011	-	.001	-	S	-	.3	S
Bromley	-	-	.007	-	.007	-	-	-	S	-	.4	S
Cold Springs	-	-	.007	-	.007	-	.001	-	S	-	.4	S
Highland Heights	-	.002	.005	-	.012	-	-	-	S	-	.5	S
Silver Grove	-	-	.001	-	-	.008	.001	.12	S	-	.8	S
Taylor Mill	-	-	.007	-	-	-	-	-	S	-	.4	S
Walton	-	.001	.005	-	.020	-	.001	-	S	-	.3	S

Table V Mandatory & Physical Limits

Water System Population < 1000	Cr 0.05	Ag 0.05	Se 0.01	As 0.05	Pb 0.05	Cn 0.2	Cd .01	B 5.0	Rating	Color 15	Turb. 5	Rating
Ohio												
Epworth Heights	-	.002	.003	-	.017	-	.002	-	S	-	.1	S
Pennyroyal M.P.	-	.001	.003	-	.011	-	-	-	S	-	.1	S
Roachester M.P.	.024	.001	.002	-	.022	-	.003	.13	S	-	.3	S
Twightwee	.043	.002	.004	-	.017	.008	.001	.16	S	-	.2	S
Indiana												
Dillsboro	.013	.002	.004	-	.011	-	.002	-	S	-	.2	S
Elrod	.012	.001	.004	-	.007	-	.002	-	S	-	.1	S
Kentucky												
Mentor M.P.	-	-	.007	-	.011	.004	.001	-	S	-	1.3	S
Wilder	-	-	.007	-	-	-	-	-	S	-	.4	S
Winston Park	-	-	.007	-	.007	-	-	-	S	-	.4	S
SEPARATE SYSTEMS												
Ohio												
Lotton	.012	-	.003	-	.009	-	.001	.12	S	-	.2	S
Maple Leaf	.013	-	.003	-	-	-	.001	-	S	-	.4	S
Mobile Manor	-	-	X	X	-	X	-	X	-	X	X	-
Otterbein Home	-	-	.001	-	.013	.002	.001	-	S	-	.1	S
Shadow Lake	-	.001	.008	-	.005	-	-	-	S	5	2.5	S
Kentucky												
Craig Trailer Park	.038	-	.002	-	-	-	.001	.10	S	-	.3	S
River Ridge Park	-	-	.002	-	.015	-	.001	.19	S	-	.3	S
Skyline Trailer Park	-	-	.001	-	-	-	.002	.17	S	15	14	U

Phenols not done
X: Sample not run
-: Sample results zero

Table VI - Recommended Limits

Note: As & Cn recommended limits of .01 and the B recommended limit of 1 were not exceeded by any sample. (See Table V)

Water System Population > 10000	MABS 0.5	Cl 250	Cu 1.0	CCE 0.2	F 1.2	Fe 0.3	Mn 0.05	NO_3 45	SO_4 250	TDS 500	Zn 5.0	DDT ppb	Gross Beta 1000 pCi/l	Rating
Ohio														
Cincinnati	.03	40	.04	.14	.19	.04	.001	6	87	241	.01	<.1	-	S
Franklin	.07	18	.01	X	.26	.02	.009	10	44	324	.03	X	2	S
Indian Hills	.04	49	.12	X	1.00	.01	.004	6	54	400	.04	X	-	S
Miami-Goshen-Stonelick	.04	44	.04	X	.10	.08	.004	9	50	356	.36	X	1	S
Norwood	.03	40	.04	.14	.19	.04	.001	6	87	241	.01	<1	-	S
Pierce-Union-Batavia	.02	42	.12	X	.14	.03	.003	5	94	409	.01	X	-	S
Reading	.03	10	.02	X	.12	.01	-	4	216	581	<.01	X	-	U
Kentucky														
Campbell Co. W.D.#1	.04	25	<.01	.05	.17	.01	.001	6	86	206	<.01	<.1	1	S
Covington	.16	23	<.01	.11	.31	<.01	.183	2	79	230	.01	<.1	-	U
Florence	.04	14	<.01	.10	.70	.02	.002	2	42	194	.01	<.1	2	S
Kenton Co. W.D. #1	.04	14	.01	.10	.70	<.01	.001	2	42	194	.02	<.1	2	S
Newport	.18	26	<.01	.05	.20	.04	.004	8	86	258	.02	<.1	1	S
5000<Population≤10000														
Ohio														
Deerfield-Hamilton W.D.	.03	31	.02	X	.21	.02	.003	5	69	504	<.01	X	1	S
Harrison	.03	22	.03	X	.20	.10	.131	3	63	333	.01	X	-	U
Lebanon	.04	52	.06	X	.28	.12	.005	<1	85	431	.03	X	-	S
Lockland	.02	25	<.01	X	.10	.01	.001	-	93	186	<.01	X	1	S
Loveland	-	16	.08	X	.15	.02	.002	6	50	357	.02	X	2	S
Mason	.01	34	.06	X	.26	.13	.024	3	40	351	<.01	X	-	S
Wyoming	.03	68	.01	.01	.98	.01	.002	2	95	306	<.01	X	-	S
Indiana														
Aurora	.08	11	.08	.012	.94	.02	.005	24	56	442	.39	X	-	S
Lawrenceburg	.10	56	<.01	X	.20	.01	.002	6	93	539	.17	X	-	U
Kentucky														
Ludlow	.16	23	<.01	X	.20	<.01	.242	2	79	230	.01	X	X	U

Table VI - Recommended Limits

Water System	MABS	Cl	Cu	CCE	F	Fe	Mn	NO_3	SO_4	TDS	Zn	DDT	Gross Beta	Rating
	0.5	250	1.0	0.2	1.2	0.3	0.05	45	250	500	5.0	ppb	1000 pCi/l	
1000<Population≤5000														
Ohio														
Addyston	.06	15	<.01	X	.26	.02	.014	3	94	314	.01	X	1	S
Batavia	.03	23	<.01	.07	.10	.07	.002	4	65	161	.02	<.1	3	S
Bethel	.09	17	.02	.07	.17	.01	.005	2	74	241	.01	<.1	3	S
Cleves	.04	26	.03	X	.13	.01	.002	7	77	277	<01	X	1	S
Felicity	.10	29	.05	X	.15	.08	.271	6	48	359	.01	X	2	U
Franklin W.D.	.07	18	.02	X	.27	.02	.007	10	44	324	.03	X	X	S
Glendale	.02	23	<.01	X	1.06	.01	.001	-	21	129	.03	X	-	S
Lebanon-Franklin W.D.	.04	52	.02	X	.26	.12	.005	<1	85	431	.01	X	X	S
Milford	.03	41	.03	X	.24	<.01	-	20	57	184	.02	X	2	S
Morrow	.03	36	.04	X	.20	.06	.004	<1	45	403	.02	X	-	S
New Richmond	.03	25	<.01	X	.13	.02	.009	9	93	277	<.01	X	2	S
South Lebanon	.04	76	.05	X	.15	.03	.021	25	75	507	<.01	X	7±4	S
Springboro	.07	19	.03	X	.21	.10	.003	<1	42	331	.32	X	-	S
Waynesville	.07	21	.03	X	.10	.02	-	9	55	344	.02	X	2	S
Williamsburg	.04	18	<.01	X	.19	.02	.002	3	78	277	<.01	<.1	3	S
Indiana														
Greendale	.08	23	.04	X	.45	<.01	-	12	53	372	.25	X	-	S
North Dearborn	.08	23	.14	X	1.16	.03	-	12	53	372	.06	X	X	S
Tri-Township	.06	21	.03	X	.11	<.01	-	4	55	366	.05	X	1	S
Kentucky														
Boone Co. W.D.	.05	13	.06	.11	.19	.02	.239	9	70	221	.02	<.1	2	U
Bromley	.16	23	<.01	.11	.20	<.01	.232	2	79	230	<01	<.1	2	U
Cold Springs	.16	23	.02	.11	.18	.02	.230	2	79	230	.02	<.1	2	U
Highland Heights	.18	26	<.01	.05	.18	.02	-	8	86	258	.01	<.1	1	S
Silver Grove	.21	143	<.01	X	.14	.02	.009	<1	73	383	<01	X	-	S
Taylor Mill	.16	23	<.01	.11	.21	.02	.240	2	79	230	.01	<.1	-	U
Walton	.04	13	.02	.19	.25	.17	.008	2	59	216	.02	<.1	3	S

Table VI - Recommended limits

Water System	MABS 0.5	Cl 250	Cu 1.0	CCE 0.2	F 1.2	Fe 0.3	Mn 0.05	NO_3 45	SO_4 250	TDS 500	Zn 5.0	DDT ppb	Gross Beta 1000 pC/l	Rating
Population <1000														
Ohio														
Epworth Heights	.18	16	.03	X	.09	.01	.002	8	49	389	.01	X	-	S
Pennyroyal W.D.	.04	7	.03	X	.25	.03	.006	2	10	254	.04	X	X	S
Roachester W.D.	.03	36	.03	X	.21	.29	.013	1	45	403	.01	X	X	S
Twightwee	.04	29	<.01	X	.16	.06	.001	46	40	575	.06	X	-	U
Indiana														
Dillsboro	.11	8	.02	X	1.00	.02	-	22	61	425	.41	X	-	S
Elrod	.08	11	.10	X	.95	.06	.005	24	56	442	.05	X	X	S
Kentucky														
Mentor W.D.	.04	25	.01	.05	.16	.04	.002	6	86	206	.05	.1	1	S
Wilder	.16	23	.02	.11	.15	.11	.236	2	79	230	.01	.1	-	U
Winston Park	.16	23	<.01	X	.22	.01	.246	2	79	230	.01	.1	-	U
SPECIAL SYSTEMS														
Ohio														
Lotton	.04	25	.06	X	.18	.01	.002	12	57	308	.03	X	X	S
Maple Leaf	.03	56	<.01	X	.19	.25	.181	-	60	358	.25	X	X	U
Mobile Manor	X	X	<.01	X	.21	3.10	.045	X	X	X	.24	X	X	U
Otterbein Home	.04	30	.02	X	.19	.01	.001	9	43	432	.01	X	-	S
Shadow Lake	.06	29	.02	.04	.15	.14	.007	3	44	304	1.06	.1	2	S
Kentucky														
Craig Trailer Park	.04	-	.01	X	.17	.14	.003	23	10	265	.38	X	X	S
River Ridge Park	.03	21	.02	X	.08	.01	.012	8	86	479	.21	X	X	S
Skyline Trailer Park	.02	67	.04	X	.14	6.00	.307	1	88	498	.04	X	X	U

APPENDIX B

FORMS USED TO GATHER DATA

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Consumer Protection and Environmental Health Service
Environmental Control Administration
Bureau of Water Hygiene

INVENTORY OF MUNICIPAL WATER FACILITIES

STATE

Correct legal name

Postal address of utility

-75-

MUNICIPAL WATER SUPPLY SANITARY SURVEY

Exp. March 1970

SURVEY DATE

1. Leave this blank (for office use only) 12 (DUP ON EVERY CARD) Date of your visit: 13 mo. day yr. 18

2. Name of supply Same as on inventory

3. Location Same as on inventory
post office common name, if different

4. Demand: MGD:

	PRESENT	10-YR. ESTIMATE	UNKNOWN
A. Avg. day	From Plant Records	24 X 28	30
B. Max. day	31 X 35	36 X 40	42
C. Max. month	43 X 47	48 X 52	54

5. Water use has been restricted [ ][ ] (55 56) times for a total of [ ][ ][ ] (57 59) days during any one year of the past 5 years.

6. LABORATORY CONTROL

A. Bacteriological (Distribution system only) From Fig 1- D.W.S

(1) Min. number samples recommended per month by PHS DWS → [ ][ ][ ] (60 62) UNKNOWN

(2) Avg. number/month for last 12 months [ ][ ][ ] (63 65) UNKNOWN [ ] (67)

(3) Range of least and most monthly samples May be from zero (68 70) to [ ][ ][ ] (71 73) UNKNOWN [ ] (75)

(4) Number of months the Drinking Water Standards were not met during the last 12 months for: END CARD ONE [1] (80) No. of months UNKNOWN

(a) Quality – Sec 3.2 - D.W.S. [ ][ ] (13 14) [ ] (15)

(b) Number of samples {Months when sample numbers < no. in 6.A.(1) [ ][ ] (16 17) [ ] (18)

(c) NONE collected No samples for ___ months. [ ][ ] (19 20) [ ] (21)

(5) Are samples representative of distribution system? Judge from map of distribution system. [ ] (22) yes [ ] (23) no

(6) Are check samples collected as provided for in the Drinking Water Standards? Sec 3.15 - D.W.S. [ ] (24) yes [ ] (25) no

(7) Are samples requiring check samples reported by telephone? [ ] (26) yes [ ] (27) no

(8) Is the laboratory certified? [ ] (28) yes [ ] (29) no

(a) Within the past 2 years? [ ] (30) yes [ ] (31) no

(b) If answer to one or both, by whom was it certified. Information from operator [ ] (32) State [ ] (33) PHS

(9) Are samples received by lab within 30 hours? [ ] (34) yes [ ] (35) no

From plant records

ECA-19

B. Chemical (finished water only)

B(1)-(4) refer to Sec 5.2-D,W.

(1) Samples of finished water are analyzed each ☐ month, ☐ year, ☐ 2 years, ☐ 3 years, ☐ infrequently ☐ never.

(2) Type of analysis: ☐ everything complete (DWS) ☐ partial. If any constituent missed

(3) Date of last chemical analysis ☐☐ mo. ☐☐ day ☐☐ yr.

(4) Analyzed by ☐ utility, ☐ state, ☐ PHS, ☐ university, ☐ other.

(5) Tests run for operational control and their frequency are:

Tests	Frequency				
	Continuous	Each shift	Daily	Weekly	Less frequently than weekly
Alkalinity	☐	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐	☐
Chloride	☐	☐	☐	☐	☐
Chlorine residual	☐	☐	☐	☐	☐
(END CARD TWO) ☐ 80					
Color	☐	☐	☐	☐	☐
Fluoride	☐	☐	☐	☐	☐
Hardness	☐	☐	☐	☐	☐
Iron	☐	☐	☐	☐	☐
Jar tests	☐	☐	☐	☐	☐
Manganese	☐	☐	☐	☐	☐
pH	☐	☐	☐	☐	☐
Taste & Odor	☐	☐	☐	☐	☐
Turbidity	☐	☐	☐	☐	☐
Zeta potential	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐

Note other frequencies

C. Radioactivity

(1) Samples are analyzed each ☐ month, ☐ year, ☐ 2 years, ☐ 3 years, ☐ infrequently ☐ never. (END CARD 3) ☐ 80

(2) Date of last radiological analysis ☐☐ mo. ☐☐ day ☐☐ yr.

(3) Analyzed by ☐ utility, ☐ state, ☐ PHS, ☐ university, ☐ other. (specify)

7. SANITARY SURVEY

A. Date of most recent survey [ ][ ] mo. [ ][ ] day [ ][ ] yr. By others - Not of this one

B. Survey made by: [ ] 31 state, [ ] 32 PHS, [ ] 33 local health department, [ ] 34 utility, [ ] 35 consultant. "Survey" requires written report of finding

C. Facilities surveyed: [ ] 36 source, [ ] 37 transmission, [ ] 38 treatment, [ ] 39 storage, [ ] 40 distribution.

8. FACILITIES & OPERATION (describe deficiencies on reverse side)

	YES	NO
A. Are there common walls between finished and lesser quality water?	[ ] 41	[ ] 42
B. Are there inter-connections to other "systems" {Sub-divisions, private industrial, community indicated by state health dept acceptance.		
(1) of known acceptable quality	[ ] 43	[ ] 44
(2) of unknown quality		
(a) with protection Note how protected	[ ] 45	[ ] 46
(b) without protection	[ ] 47	[ ] 48
C. Is there a cross-connection control program		
(1) on new construction only	[ ] 49	[ ] 50
(2) for continuous re-inspection	[ ] 51	[ ] 52
D. Are finished water reservoirs properly covered?	[ ] 53	[ ] 54
E. Is there detectable chlorine residual in distant parts of the distribution system?	[ ] 55	[ ] 56
F. Can the treatment plant be by-passed?	[ ] 57	[ ] 58
G. Are there satisfactory procedures to:		
(1) prevent personal accidents	[ ] 59	[ ] 60
(2) prevent chlorine accidents	[ ] 61	[ ] 62
(3) disinfect all new and/or repaired distribution system mains, valves, fittings, including check samples before being placed in service?	[ ] 63	[ ] 64
H. Are there areas of low pressure (< 20 psi) in the distribution system under maximum water use?	[ ] 65	[ ] 66

I. Operating problems most often encountered are: [ ] 67 taste & odor [ ] 68 phenols, [ ] 69 corrosive water, [ ] 70 short filter runs, [ ] 71 other, specify.

ECA-19

8. FACILITIES & OPERATION, continued

J. Chlorination process was interrupted ☐☐ (72 73) times in the last 12 months.

(1) Interruptions were due to: ☐ (74) chlorinator failure, ☐ (75) feedwater pump, ☐ (76) changing cylinders, ☐ (77) power failure, ☐ (78) other, explain. (END CARD 4) ☐ (80)

K. Percent of land area within service area where water is available (nearest whole percent) ☐☐☐ (13 15) %.

L. Were plans and specs. for treatment plant approved by the state? YES ☐ (16) NO ☐ (17)

9. SOURCE, TREATMENT & DISTRIBUTION (describe deficiencies on reverse side) Note

A. Are the following adequate:

	YES	NO
(1) Source, with respect to the following:		
(a) quantity	☐ (18)	☐ (19)
(b) bacteriological quality	☐ (20)	☐ (21)
(c) chemical quality	☐ (22)	☐ (23)
(d) physical quality	☐ (24)	☐ (25)
(e) adequate protection	☐ (26)	☐ (27)
(2) Transmission of raw water	☐ (28)	☐ (29)
(3) Is the raw water sampled for:		
(a) Bacteriological contamination	☐ (30)	☐ (31)
(b) Chemical contamination	☐ (32)	☐ (33)
(4) Treatment, with respect to the folowing:		
(a) aeration	☐ (34)	☐ (35)
(b) chemical feed, capacity	☐ (36)	☐ (37)
(c) chemical feed, stand-by equipment	☐ (38)	☐ (39)
(d) chemical mixing	☐ (40)	☐ (41)
(e) flocculation	☐ (42)	☐ (43)

Refer to PHS No. 1820

9. SOURCE, TREATMENT & DISTRIBUTION, continued

A. Are the following adequate (continued):

	YES	NO
(4) Treatment, continued:		
(f) settling	44	45
(g) recarbonation	46	47
(h) filtration At normal operating rates	48	49
(i) disinfection, capacity	50	51
(j) disinfection, stand-by equipment	52	53
(k) taste & odor control	54	55
(l) fluoridation	56	57
(5) Distribution, with respect to the following:		
(a) storage	58	59
(b) booster chlorination	60	61
(c) high service pumping	62	63
(d) booster pumping	64	65
(e) pressure	66	67
(6) Maintenance	68	69
(7) Records for:		
(a) disinfection	70	71
(b) filter runs	72	73
(c) chemical consumption	74	75
(d) operational control tests	76	77
(e) bacteriological examinations	78	79
(8) Cross-connection control	END CARD 5	5/80
(a) ordinance	13	14
(b) program implementation	15	16
(c) progress	17	18

9. SOURCE, TREATMENT & DISTRIBUTION, continued

B. During the past 3 years, raw water quality has ☐ (19) improved, ☐ (20) deteriorated, or ☐ (21) stayed the same.

10. PERSONNEL

A. Water Purification Operator

This is the responsible plant operator - Not sup't.

(1) Highest level of formal education: ☐ (22) 8th grade or less, ☐ (23) high school, ☐ (24) technical or trade school, ☐ (25) university.

(2) Level of training in water treatment: ☐ (26) college course, ☐ (27) technical or trade school, ☐ (28) short school, ☐ (29) on the job, ☐ (30) none, ☐ (31) other, specify _____.

Get operator data for there each supply even if there is no treatment.

(3) Length of time on this job: ☐☐ (32 33) years, ☐☐ (34 35) months.

(4) Number of previous positions as water treatment operator ☐☐ (36 37)

(5) Total years of water purification experience ☐☐ (38 39)

(6) Level of study in sanitary microbiology: ☐ (40) college course, ☐ (41) technical or trade school, ☐ (42) short school, ☐ (43) on the job, ☐ (44) none, ☐ (45) other, specify _____.

(7) Level of study in water chemistry: ☐ (46) college course, ☐ (47) technical or trade school, ☐ (48) short school, ☐ (49) on the job, ☐ (50) none, ☐ (51) other, specify. _____.

(8) Is the operator a full-time employee? ☐ (52) yes ☐ (53) no

(9) Salary range (per year) of operator: ☐ (54) <$1,999 ☐ (55) $2,000-4,999 ☐ (56) $5,000-7,499 ☐ (57) $7,500-9,999 ☐ (58) $10,000

10. PERSONNEL, continued

A. continued

(10) Is your present staff adequate in: Operator's opinion

(a) number ☐ 60 yes ☐ 61 no

(b) quality ☐ 62 yes ☐ 63 no

B. Operator's major complaint _____

C. Most frequent customer's complaint: Received by utility.

D. Management's most frequent complaint: _____

II. FINANCIAL INFORMATION

A. Bonded indebtedness: (water supply)

(1) General obligation bonds $ [ ]. END CARD 6 [6] 80

(a) statutory limit $ [ ].

(2) Revenue bonds $ [ ].

(a) statutory limit $ [ ].

B. Capital stock, par value $ [ ].

bonds, par value $ [ ].

C. Water funds are [ ] kept separate or [ ] mingled with other funds.

D. Is there an annual payment to the general fund? [ ] yes [ ] no

E. Operation is controlled by: [ ] mayor-council, [ ] mayor-commission, [ ] independent water board, [ ] other, specify. _____

For city, district, etc owned only

F. Is there active planning for expansion or improvement? [ ] yes [ ] no

(1) Value of planned improvement $ [ ].

(2) Planning by utility [ ] yes [ ] no utility only

(3) Planning by consultants [ ] yes [ ] no utility & consultants

END CARD 7 [7] 80

G. If expansion is planned, it will be carried out within:

	1 YR.	2-5 YRS.	6-10 YRS.
(1) Source	[ ]	[ ]	[ ]
(2) Treatment	[ ]	[ ]	[ ]
(3) Distribution	[ ]	[ ]	[ ]
(4) Other _____	[ ]	[ ]	[ ]

H. Costs of production:

	CENTS/1,000 GALLONS
(1) Chemicals	[ ]. [ ]
(2) Labor, power, etc.	[ ]. [ ]
(3) Depreciation	[ ]. [ ]
(4) Other, including office, administration, meter reading, collection, etc.	[ ]. [ ]
(5) Total	[ ]. [ ]

11. FINANCIAL INFORMATION, continued

1. Tariff (Residential)

(1) Connection fee $ [ ][ ].[ ][ ] (41–44)

(2) Sales unit is [ ] (45) per 1,000 gallons or [ ] (46) per 100 cu. ft.

(a) [ ][ ][ ] (47) cents for the first [ ][ ] (50–51) units

(b) [ ][ ][ ] (52) cents for the next [ ][ ] (55–56) units

(c) [ ][ ][ ] (57) cents for the next [ ][ ] (60–61) units

(d) etc. as needed to cover steps.

Adjust all rates to these units.

END CARD B [B] (80)

Note flat rate here as $/time unit

ENVIRONMENTAL CONTROL ADMINISTRATION

BUREAU OF WATER HYGIENE

IDENTIFICATION OF WATER SAMPLE

9111

PUNCH IN COLS. 1 6

1. LOCATION OF WATER SUPPLY Same as on inventory
CITY, COUNTY, STATE

FOR OFFICE USE ONLY [ ] 7 18

DO NOT WRITE BELOW THIS LINE

2. WATER SUPPLY NAME Same as on inventory

3. DATE OF SAMPLING BEGINNING DATE OF COMPOSITE MO. DAY [ ] 19 22 ENDING DATE OF COMPOSITE OR DATE OF GRAB SAMPLE MO. DAY YR. [ ] 23 28

4. SAMPLE FROM [ ] TREATMENT PLANT 8 [ ] WELL 4 [ ] RESERVOIR 2 [ ] DISTRIBUTION SYSTEM 1 [ ] OTHER 0 [ ] 29

5. SAMPLING POINT LOCATION AND/OR DESCRIPTION ie. kitchen 1234 Main [ ] 30 32

6. TYPE OF WATER SAMPLED [ ] FINISHED 8 [ ] PARTIALLY TREATED 4 [ ] RAW 2 [ ] OTHER 0 [ ] 33

7. SOURCE OF WATER [ ] SURFACE 8 [ ] GROUND 4 [ ] COMBINED 2 [ ] OTHER 0 [ ] 34

8. SAMPLING METHOD [ ] COMPOSITE 8 [ ] GRAB 4 [ ] OTHER 0 [ ] 35

9. ANALYSIS REQUIRED [ ] ORGANIC 8 [ ] TRACE ELEMENTS 4 [ ] WET 2 [ ] RADIO-CHEMICAL 1 [ ] OTHER 0 [ ] 36

10. WATER SUPPLY CATEGORY [ ] COMMUNITY WATER SUPPLY 8 [ ] ICWS 4 [ ] FEDERAL INSTALLATION 2 [ ] SPECIAL STUDY 1 [ ] OTHER 0 [ ] 37 39

11. APPEARANCE OF SAMPLE color, taste, odor

12. ADDITIONAL REMARKS pH, Cl, temperature, pressure

13. COLLECTED BY _____ [ ] USPHS STAFF [ ] OTHER [ ] 1 80

DO NOT WRITE BELOW THIS LINE

LAB. SAMPLE NO. _____ DATE RECEIVED _____

LABORATORY REMARKS

OVER FOR INSTRUCTIONS

INSTRUCTIONS: EVERY ITEM OF INFORMATION REQUIRED FROM THE SAMPLER IS NUMBERED (1 THROUGH 13). THESE ARE THE ONLY RESPONSES THE SAMPLER SHOULD MAKE. NOTE AREAS MARKED "DO NOT WRITE BELOW THIS LINE" AND "FOR OFFICE USE ONLY."

ITEM 1 SHOULD BE THE LOCATION OF THE WATER SUPPLY FACILITY WHICH PRODUCED THE WATER FOR THE SAMPLE. (EXAMPLE: CINCINNATI, HAMILTON, OHIO.)

ITEM 2 SHOULD BE THE FULL NAME OF THE WATER SUPPLY FACILITY. (EXAMPLE: CINCINNATI MUNICIPAL WATER WORKS)

ITEMS 4, 6, 7, AND 8 - CHECK THE BOX WHICH APPLIES

ITEMS 9 AND 10 - CHECK ONE OR MORE BOXES AS NECESSARY

ITEMS 3, 5, 11, 12, AND 13 SHOULD BE SELF-EXPLANATORY

ANY RESPONSE OF "OTHER" OR "SPECIAL STUDY" SHOULD BE EXPLAINED UNDER ITEM 12 - ADDITIONAL REMARKS.

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WATER QUALITY REGISTER BRANCH
BUREAU OF WATER HYGIENE
222 E. CENTRAL PARKWAY
CINCINNATI, OHIO 45202

BLUE	ENCLOSED WITH ORGANIC SAMPLE
PINK	ENCLOSED WITH TRACE METAL SAMPLE
YELLOW	ENCLOSED WITH WET CHEMISTRY SAMPLE
GREEN	ENCLOSED WITH RADIOCHEMICAL SAMPLE
TAN	RETAINED BY REGIONAL OFFICE OR SAMPLER